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Maintenance Management of U.S. Army Railroad Networks — The RAILER System:

Component Identification and Inventory Procedures

by
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The U.S. Army Construction Engineering Research Laboratory (USA-CERL) is developing the Railroad Maintenance Management System (RAILER) as a comprehensive program for track inventory, inspection, maintenance, and repair. The Army previously had no standard, systematic approach to maintaining trackage on its installations. When RAILER is completed and field-tested successfully, it will be available to installations for (1) locating and identifying physical assets, (2) assessing conditions, (3) determining maintenance and repair (M&R) needs, and (4) planning M&R work.

This report describes the first phase of RAILER—location and identification of physical assets. This phase is fundamental to any level of implementation for the system. Procedures are described for dividing installation railroad track networks into specific tracks and track segments. A location reference system is explained with examples and illustrations provided. Finally, this volume identifies major inventory data elements and important element attributes needed for maintenance management along with methods of data collection.

Future technical reports will describe track inspection procedures; the development of interim railroad maintenance procedures; a project prioritization method; track evaluation procedures; finalized railroad maintenance management practices using RAILER; and long-range work planning.

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Future technical reports will describe track inspection procedures; the development of interim railroad maintenance procedures; a project prioritization method; track evaluation procedures; finalized railroad maintenance management practices using RAILER; and long-range work planning.

FOREWORD

This research was conducted for the U.S. Army Engineering and Housing Support Center (USAEHSC), under Project 4A16273AT41, "Military Facilities Engineering Technology"; Task C, "Operation, Management, and Repair"; Work Unit 042, "Railroad Maintenance Management System." The work was conducted by the Engineering and Materials Division (EM), U.S. Army Construction Engineering Research Laboratory (USA-CERL). The USAEHSC Technical Monitor was Robert Williams, CEHSC-FB-P.

A very special acknowledgment is given to Dr. E. S. Dierenfeld for her work in assembling and drafting portions of this report.

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Dr. R. Quattrone is Chief, USA-CERL-EM. COL Carl O. Magnell is Commander and Director of USA-CERL, and Dr. L. R. Shaffer is Technical Director.

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1 INTRODUCTION

Background

At present, the Army has no comprehensive railroad track maintenance management system with full decision support capability. Existing inventory and inspection procedures are rudimentary at best.

Current inventory procedures consist solely of recording total track miles at an installation into the Integrated Facilities System (IFS)[1] and/or real property records. This simple track mileage inventory, although adequate for reporting total railroad trackage assets for an installation or the Army as a whole, is totally inadequate for supporting maintenance management.

Inspection of Army railroad networks follows procedures outlined in the *Real Property Maintenance Activities (RPMA) Component Inspection Handbook.*[2] These guidelines provide only very general methods for inspecting trackage and ties.

To provide for a comprehensive, systematic approach to railway maintenance management, the Army has initiated development of improved railroad maintenance standards, including inspection elements, frequencies, and procedures.[3] As part of this effort, the U.S. Army Construction Engineering Research Laboratory (USA-CERL) has been asked to investigate a systems approach that incorporates these standards. As part of this work, USA-CERL is developing the Railroad Maintenance Management System (RAILER).[4]

RAILER is one of several Engineered Management Systems (EMSs) being developed at USA-CERL. An EMS uses database management technology to facilitate maintenance management decision support. RAILER is a railroad maintenance management system designed primarily for U.S. Army installations. It will enable effective, efficient management of Army trackage through systematic procedures such that critical portions of the network are maintained in optimal condition at the least possible cost consistent with mission. RAILER accomplishes this task by coupling civil, railroad, and maintenance engineering with database management technology to facilitate decision support; in particular, it permits managers to develop annual and long-range work plans easily.

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[1] *Integrated Facilities System User's Manual* (Facilities Engineering Support Agency [FESA], Fort Belvoir, VA, January 1979).

[2] *RPMA Component Inspection Handbook* (FESA, Fort Belvoir, VA, May 1979).

[3] *Technical Manual (TM) 5-628, Railroad Track Standards* (Headquarters, Department of the Army [HQDA], May 1988).

[4] M. Y. Shahin, *Development of the U.S. Army Railroad Track Maintenance Management System (RAILER)*, Technical Report M-86/01/ADA168915 (U.S. Army Construction Engineering Research Laboratory [USA-CERL], January 1986).

RAILER will allow users to:

- Use standardized methods to locate and identify physical assets
- Objectively assess track conditions
- Uniformly determine maintenance and repair (M&R) needs
- Prioritize M&R projects
- Plan and schedule M&R work with a prepared railroad maintenance policy
- Predict future track condition as a function of use
- Use an institutionalized memory storage system to store data important for track M&R decisions. In addition to inventory and inspection data, this includes:
  - -- Design loads
  - -- Nondestructive test results
  - -- Work history record
  - -- Traffic (daily and mobilization).

The RAILER system consists of two generations: (1) a FORSCOM-sponsored interim railroad maintenance management system needed to support the FORMAP-2 rail rehabilitation program, and (2) the complete, fully capable system sponsored by the U.S. Army Engineering and Housing Support Ageny (USAEHSC). The fully capable version will completely fulfill the tasks specified above. The interim system, called RAILER I, will help the user to perform the same functions except for condition prediction, but with less sophistication.

The RAILER database structure required to support all the tasks specified above is illustrated in Figure 1.* This report is concerned with the aspects of RAILER that address the first task listed above--locating and identifying physical assets. The data elements associated with this task are indicated by the two dark boxes in Figure 1, and are distinguished from other RAILER data elements by their relatively permanent character.

Objectives

The objectives of this work are to:

1. Describe a procedure for dividing installation railroad track networks into specific tracks and track segments.

2. Explain the location reference system.

*Tables and figures appear at the end of each chapter.

3. Describe the major inventory data elements and important element attributes needed for maintenance management, along with the methods of data collection.

Future Technical Reports will describe track inspection procedures; development of interim railroad maintenance management practices; a project prioritization method; track evaluation procedures; finalized railroad maintenance management practices using RAILER; and long-range work planning.

Approach

In the early stages of RAILER work, an extensive R&D literature search was conducted in which commercial railroads, both large and small, were contacted to determine the industry's existing inventory and inspection methods.[5] Although various inventory systems are used in the commercial sector, none appeared applicable to Army railway networks.

USA-CERL therefore began developing procedures based on the experience and expertise of military engineers, railroad engineers, facility managers, and other experts in railroad maintenance management from both military and civilian sectors. When practical, procedures were designed to be compatible with existing Army methods and terminology, including those in IFS and Military Traffic Management Command Transportation Engineering Agency (MTMC-TEA) installation Transportation System Capability Studies (TSCS).

The first set of methods is for dividing an installation railroad track network into components--individual tracks and smaller units known as "track segments." Additional procedures were developed for these network components as well as other critical items. A location referencing system was then established. Finally, USA-CERL identified various inventory elements and their important data attributes that should be collected for each track segment to allow proper, efficient maintenance management. The procedures have been field-tested at several Army installations.

Scope

This report is the first of a series addressing the RAILER system. RAILER is intended to be a program encompassing all aspects of railway maintenance management; this report covers one part of the program--component identification and inventory procedures.

Mode of Technology Transfer

When RAILER has been completed and tested successfully, it is recommended that the technology be used to develop a new triservice Technical Manual covering railroad maintenance management for implementation throughout the Department of Defense.

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[5]S. C. Solverson, M. Y. Shahin, and D. R. Burns, *Development of a Railroad Track Maintenance Management System for Army Installations: Initial Decision Report*, Technical Report M-85/04/ADA149491 (USA-CERL, November 1984).

The procedures in RAILER also are applicable to commercial short-line railroads and portions of larger commercial systems. Thus, it is suggested that the information be disseminated among the Association of American Railroads (AAR), the American Short-Line Railroad Association (ASLRA), and the Federal Railroad Administration (FRA) for use within the civilian sector.

The RAILER technology also will be transferred through a training program conducted by USA-CERL and USAEHSC in conjunction with a major university.

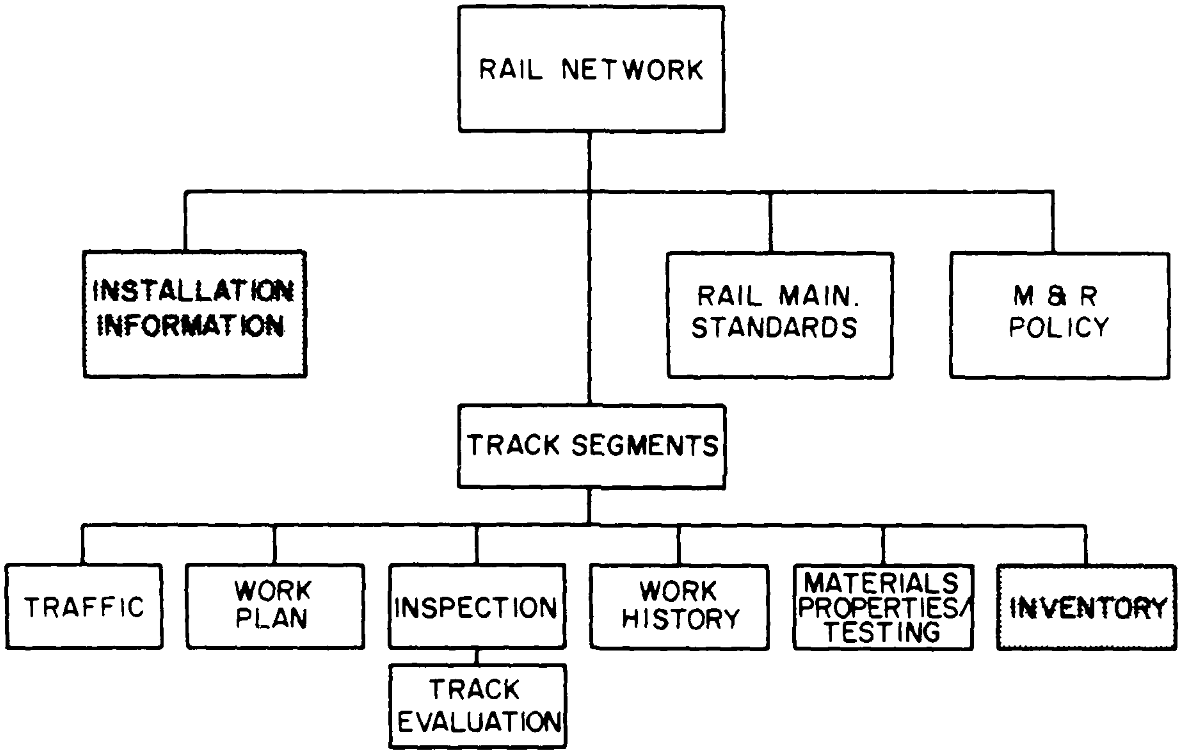

Figure 1. RAILER database structure.

2 NETWORK DIVISION AND COMPONENT IDENTIFICATION

The railroad track of an installation is usually connected together in a network. If the trackage consists of two or more isolated groups, these may be treated within RAILER as individual networks or as one aggregate network. To facilitate effective maintenance management, an installation network must be divided into logical components and other functional components must be identified. Furthermore, this process should be compatible with existing procedures, studies, and management systems within the Army. USA-CERL has developed such procedures for identifying various network components. Some of the figures and tables in this and succeeding chapters refer to a fictitious installation, "Fort Example," to help clarify the procedures.

Component Description

Four major track components have been established for unique identification within the RAILER system:

- Track--a distinct, singular branch of the normal tree-structured track network.
- Track segment--a division of a track representing the basic unit for railroad maintenance management for which inventory and inspection data will be collected.
- Turnout--an arrangement of a switch and frog with closure rails used to divert trains from one track to another.
- Curve--bends in the track designed to change the direction of travel.

To augment these definitions, the **Glossary** explains common railroad terminology used throughout this report.

Tracks

Dividing Track Network Into Tracks

Trackage enters the base at one or more connection(s) with a commercial railroad. Within the installation, the trackage generally branches out into a loose tree structure. Each branch of the tree constitutes a track.

Track Identification

Individual tracks must be labeled with unique track numbers so they can be identified easily. If numbers have already been assigned to Army tracks, they should be retained as part of the identification convention within RAILER. All unnumbered tracks should be assigned a logical numbering scheme during RAILER implementation. This number is limited to a maximum of five alphanumeric digits to facilitate integration into a computerized inventory data base. A consecutive sequence based on networking and/or geographics is recommended. Figure 2 shows the track numbering sequence for Fort Example.

Location Referencing

Once tracks have been identified, a location reference system (track stationing) should be established to assist in locating inventory items and track deficiencies. The basic units are hundred-foot lengths (or stations) followed by a "+" and then the extra feet (less than 100) to the right of the "+". Thus, station 18+46 is 1846 ft from the origin. As defined in this report, a track originates at the point-of-switch of the turnout leading to the track. Figure 3 illustrates in detail a track's point of origin at a turnout. This point of origin, by definition, is station 0+00. It is recommended that stamped metal plates (2 in. by 2 in.) be affixed to the ties every 200 ft and trackside markers visible from a locomotive be affixed every 1000 ft where practical. Figure 4 illustrates the stationing sequence for Fort Example, and Figure 5 shows a station plate affixed to a tie.

Exceptions to this stationing sequence include crossover tracks where there is less than 50 ft of track between the last switch ties of the two crossover turnouts, and connections linking installation trackage with commercial railroad(s). For practicality, crossover tracks are not stationed; in the case of linkage with commercial tracks, the point where Government ownership begins should be designated as station 0+00. When the point of Government ownership is unclear, stationing should begin at the point-of-switch where the track leading into the installation line originates.

The level of accuracy needed for the referencing system is the nearest foot. A simple measuring wheel, used either manually (Figure 6) or mounted on a track cart (Figure 7), can provide measurements to the required level of accuracy. The wheel can be placed on either rail. The accuracy of the measuring wheel should be checked daily by rolling it over a calibrated distance.

Track Segments

Dividing Tracks Into Track Segments

For effective management and network identification, tracks are divided into units called "track segments." Each track must have at least one track segment. Two required and two optional criteria are used in differentiating track segments: train operations, track use, rail weight (optional), and bridges (optional). Each of these criteria is discussed further below.

Once the tracks have been divided into appropriate track segments, they should be numbered for identification purposes. The track segment number is created by adding a two-digit suffix to the track number.

Example: M03 (This indicates the third segment of track M)

Track segment numbers created in this way must not exceed seven alphanumeric digits. Numbers should be consecutive for all track segments within a given track. Figure 8 shows the track segment numbering sequence at Fort Example.

Occasionally, it may be desirable to split a track segment into two or more segments. To retain the consecutive numbering sequence without renumbering other segments, the "new" segments would keep the original two-digit suffix plus an additional A, B, etc., for a total digit suffix of three. Fort Example segments 901A and 901B (Figure 8) are the result of dividing the first segment of track 9 into two new track segments.

Train Operations. This criterion requires that segments begin or end at virtually every turnout because a turnout allows a choice of routes. Also, since turnouts have unique inspection and maintenance requirements, it is desirable to have each one located in one and only one track segment, with the location of the switch points determining the track segment where the turnout resides. The "one segment per turnout" criterion results in segments beginning and sometimes ending at the last switch tie denoting the turnout's boundary. It should be noted that this situation usually means the first track segment of a track will not begin at station 0+00. Figure 9 illustrates this segmenting process.

The rigid application of this segmenting "turnout rule" can sometimes result in track segments that are too small to be effective maintenance management units. Crossovers and back-to-back turnouts are two such situations addressed by the RAILER segmenting criteria. In a crossover connection where there is less than 50 ft of track between the last switch ties of the two crossover turnouts, each half of the crossover is included in the track segment containing the turnout. Similarly, if the distance between the last switch ties of back-to-back turnouts is less than 50 ft, half of this length is included in each of the two adjoining segments. Figure 10 illustrates both situations. In each case, if the track length is more than 50 ft, it is treated as a separate track segment.

Tracks may exist which do not commonly have train operations over their entire length. In such cases, the active, inactive and/or relatively inactive portions of the track may be designated as separate segments. Segments 901A and 901B (Figure 8) are an example of this situation (segment 901A is active while 901B is not).

Track Use. Although many specific track functions may exist within a network, five general categories apply to track maintenance management:

- Access--tracks that provide connections between the other four types of tracks as well as those linking installation and commercial route(s).

- Auxiliary--tracks used to aid train operations including sidings, wye tracks, and runaround tracks.

- Loading--tracks used for loading and unloading mission-related equipment and supplies.

- Service--tracks used for servicing either general installation operations or railroad equipment. Includes tracks leading to a power plant, waste treatment facility, commissary, engine house, or car shop.

- Storage--tracks used for long- or short-term storage of freight cars, including classification yard tracks and interchange tracks.

Figure 11 shows track use categories assigned at Fort Example.

Note that a given track, such as Fort Example's track M, can have different primary track uses along its length. The track use segmenting criterion recognizes that different track uses imply significantly different track maintenance activities and priorities; therefore, sections of track with different primary uses should not be included within a single homogeneous maintenance management unit.

As illustrated by Figure 11, the track use criterion tends to reinforce the train operations segmenting criterion. However, track use *can* indicate segmentation whereas train operations cannot. For example, track use is the only distinction between Fort Example segments M11 and M12. (Segment M11 has auxiliary track use in support of the wye operations which also require segments M08, M09, M10, 701, 702, and Y01, whereas segment M12 is used for loading.)

Rail Weight. Sometimes when tracks are divided into track segments based on the above criteria, portions of the segment contain rail of a weight significantly different from that of other portions. Since track performance is partly a function of rail weight, it may be advantageous at times, when planning track work, to use rail weight as a segmenting criterion. However, since rail weight can be quite variable, possibly changing every two or three rail lengths, using rail weight as a segmenting criterion normally should *not* be considered. This convention should be reserved for special cases as deemed appropriate. Fort Example segment M03 (Figure 8) reflects an application of this segmenting criterion.

Bridges. Due to unique maintenance requirements of trackage over bridges as well as those of the bridge itself, track over bridges can be divided into individual segments. Figure 12 shows the limits of the track segment at a bridge.

Other Factors. Ideally, the track in any segment should have uniform traffic and physical characteristics over its entire length. Where significant changes in these characteristics occur, new segments should be created. In addition to the four parameters discussed, segments also can be differentiated based on ballast type, subgrade soil type, tie spacing, and overall track condition.

Turnouts

Turnout Identification

Turnouts are numbered individually within the track networks. If a numbering system has been established already, it is retained. Otherwise, all turnouts are numbered as follows:

(Integer) T (Diverging track number)

1. Integer. Number 1 is reserved for the turnout where the divergent track begins. The point-of-switch location for the diverging track is usually 0+00. All other turnouts leading to the same track are designated consecutively (2,3,..), in an order corresponding with increasing station location.

2. T. This letter indicates that a turnout (rather than a track, track segment, or curve) is being identified.

3. Diverging Track Number. This is the track into which the turnout diverges or leads. For example, "1T26" indicates the first turnout leading into track 26. Figure 13 presents more examples of turnout numbering. Turnout numbers should be limited to eight characters (2-1-5).

Curves

Curve Location

A curve can reside in one or more track segments, depending on where the track segments are divided. Connecting curves (those which allow a track to run parallel to its originating track) usually are not designated as curves per se and are not included in the curve-numbering sequence or curve inventory. If the distance between parallel tracks (centerline to centerline) is greater than 25 ft, the curve should not be considered a connecting curve and, thus, should be identified separately. Figure 14 shows an example of a connecting curve.

Curve Identification

Curves are numbered individually within the track networks. Since there is no existing numbering system, all curves are numbered as follows:

(Integer) C (Track number)

1. Integer. The curves in each track are numbered beginning with 1 for the first curve encountered, continuing consecutively to the end of the track.

2. C. This letter indicates that a curve (rather than a track, track segment, or turnout) is being identified.

3. Track Number. The track that contains the curve.

An example is "6C4A," which indicates the sixth curve in track 4A. Curve numbers should be limited to eight characters (2-1-5). Figure 15 shows more examples of curve numbering.

Maps

Once all tracks, track segments, turnouts, and curves have been identified and numbered, existing railroad maps of the installation should be updated to reflect this information. If maps are nonexistent or of poor quality, new railroad maps should be drawn. It is strongly recommended that installations prepare reproducible maps like the one in Figure 16. While scaled maps have obvious advantages, high quality "track diagrams" should suffice for most purposes.

Integrated Facilities System (IFS) Interface

All railroad trackage at Army installations is typically identified within IFS as a single line item reflecting total track miles. Thus, the entire track network is considered to be a single facility.[6] This concept, however, is too broad for effective maintenance management as intended with RAILER. As described in this chapter, the management unit within RAILER is the "track segment" with the basic unit of measure being track

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[6]*Integrated Facilities System User's Manual.*

feet. The relative uniformity of track segments is what will permit effective engineering analyses and decision-making. The size of the segments is what makes track feet, as opposed to track miles, an appropriate unit of measure for RAILER.

IFS is currently being redesigned at USAEHSC. Key to this redesign effort is the desire for compatibility between the EMSs developed by USA-CERL (e.g., RAILER) and the modified IFS (IFS-M). These systems serve different, but related, Directorate of Engineering and Housing (DEH) management functions. Thus, it is essential that certain data (e.g., assets accounting) required to support both systems be the same. Generally, however, EMS inventory data is much more detailed than IFS-M assets accounting data.

For railroad track networks, the interface between the two depends on the RAILER system being able to "roll up" certain track segment inventory data into appropriate facility assets accounting data needed for IFS-M. Although the specifics have not been finalized, it is plausible that a single facility of railroad track could consist of either a track or the network as a whole. Thus, an IFS-M railroad track facility would consist of one or more RAILER track segments. The lengths of the appropriate groups of track segments, in track feet, can be added together and converted into track mileage for IFS-M. Other inventory data (described later in this report) can also be "rolled up" for entry into IFS-M. The specific elements needed for IFS-M management have not been determined at this time. Once this task has been done, features within RAILER will combine the information for entry into IFS-M.

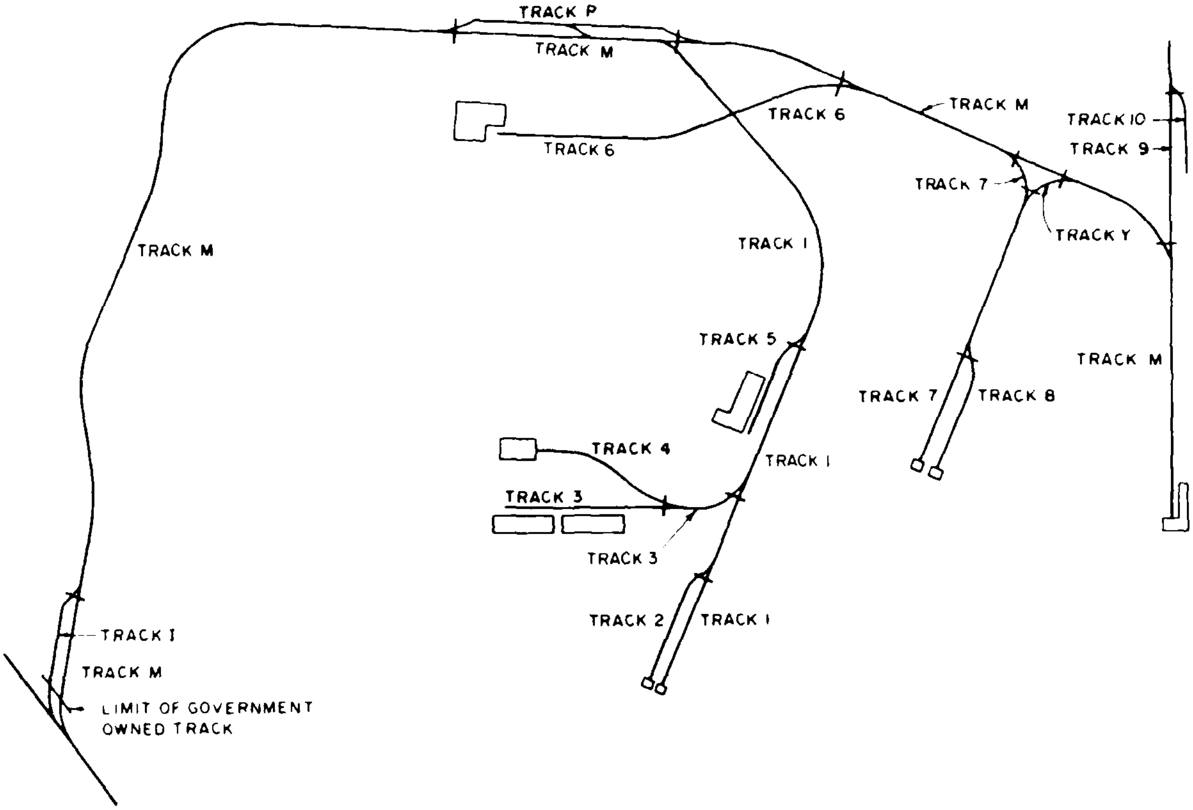


Figure 2. Track numbering sequence at Fort Example.

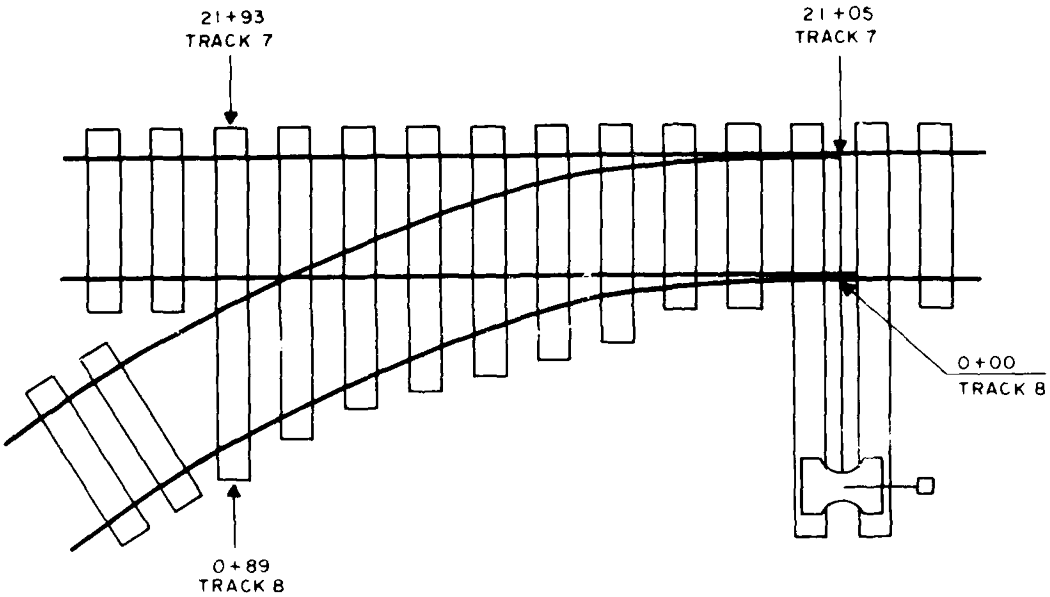


Figure 3. Track point of origin at point of switch--Fort Example.

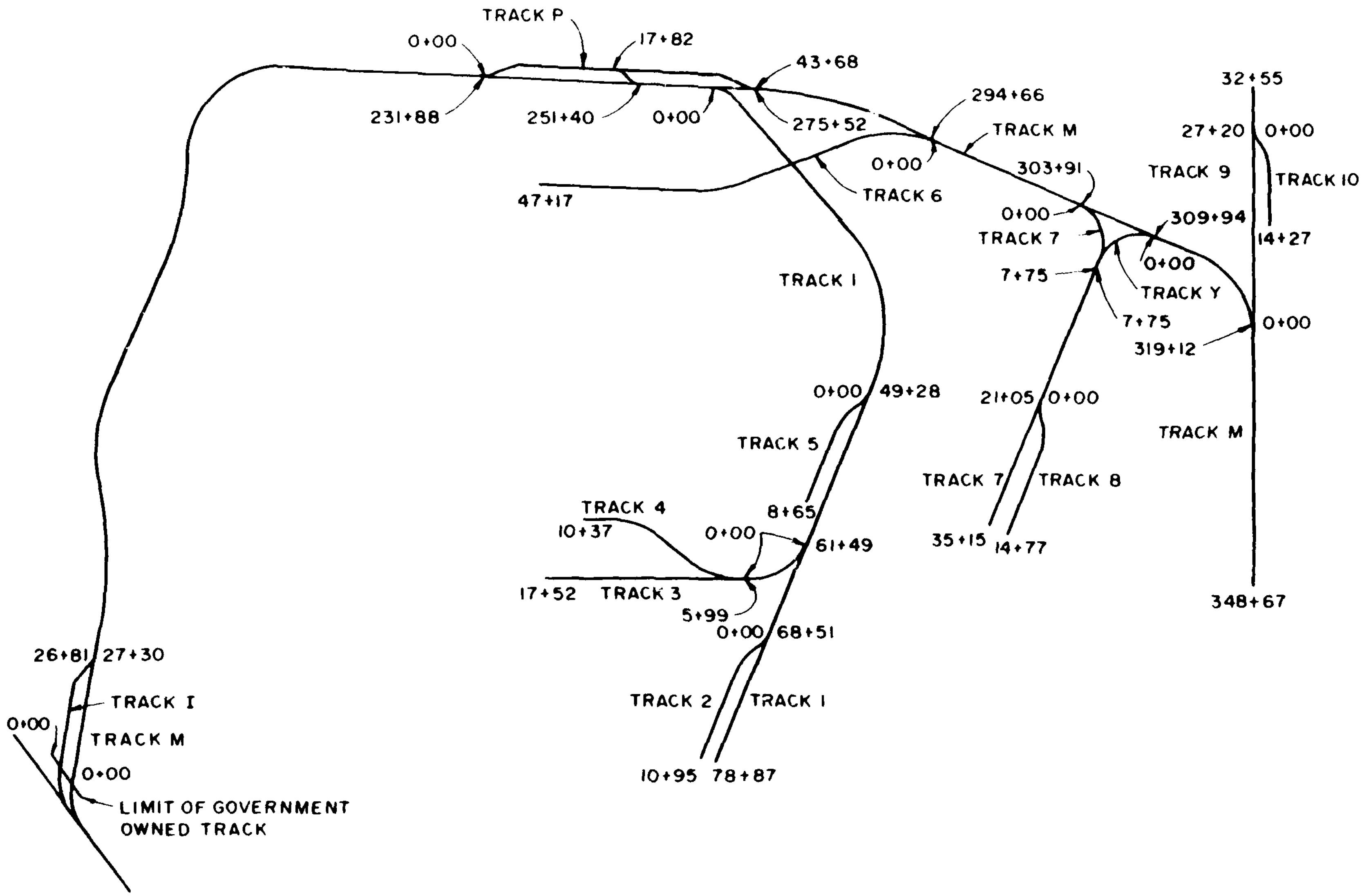


Figure 4. Track stationing sequence at Fort Example.

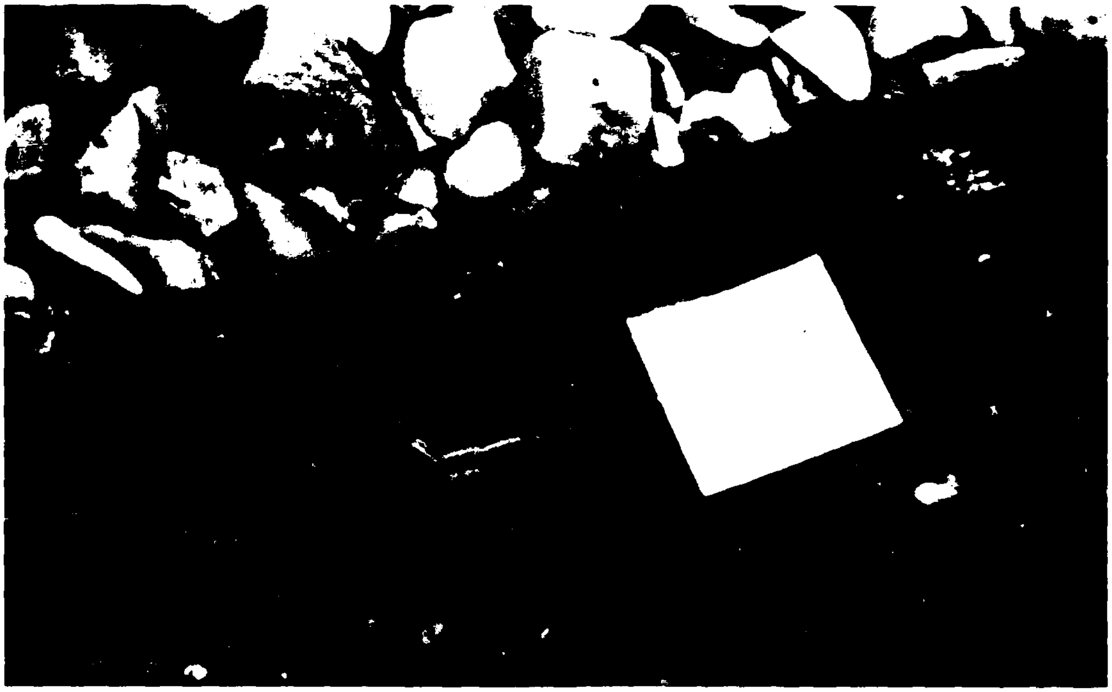


Figure 5. A station plate affixed to a tie.

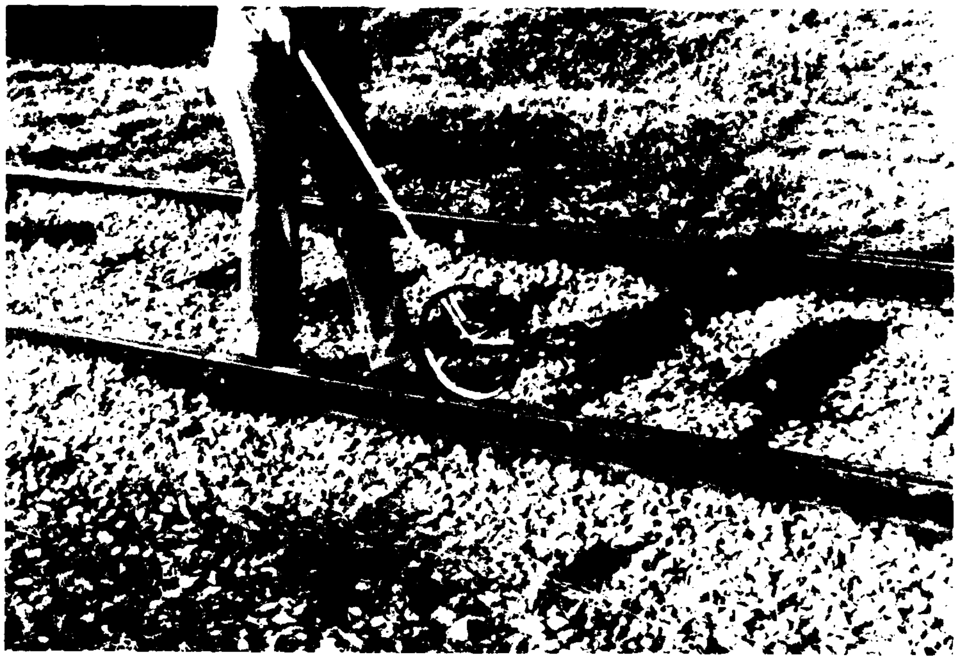


Figure 6. Manual use of measuring wheel.

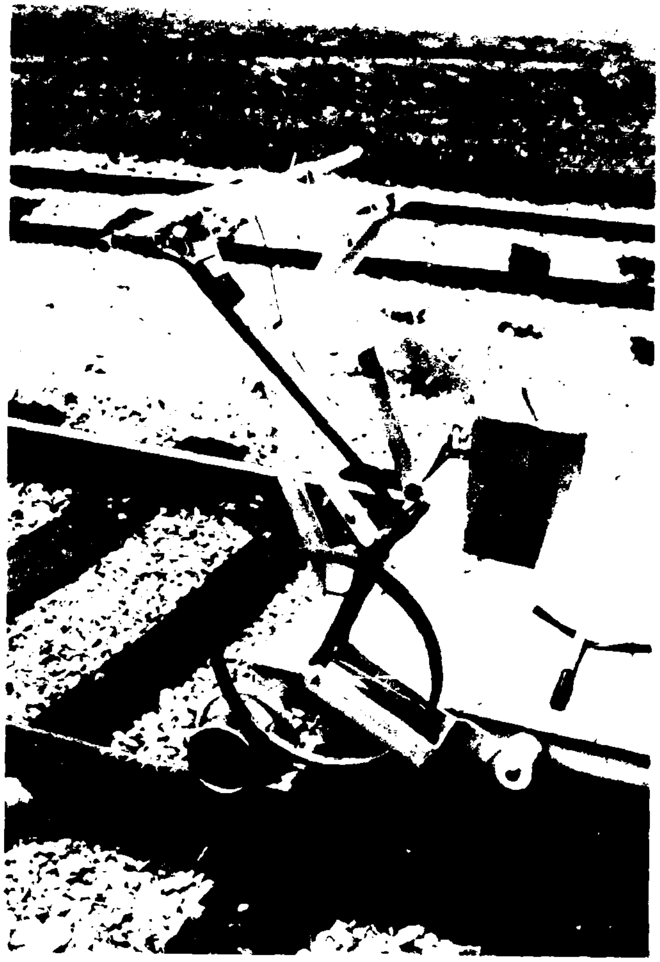


Figure 7. Measuring wheel mounted on track cart.

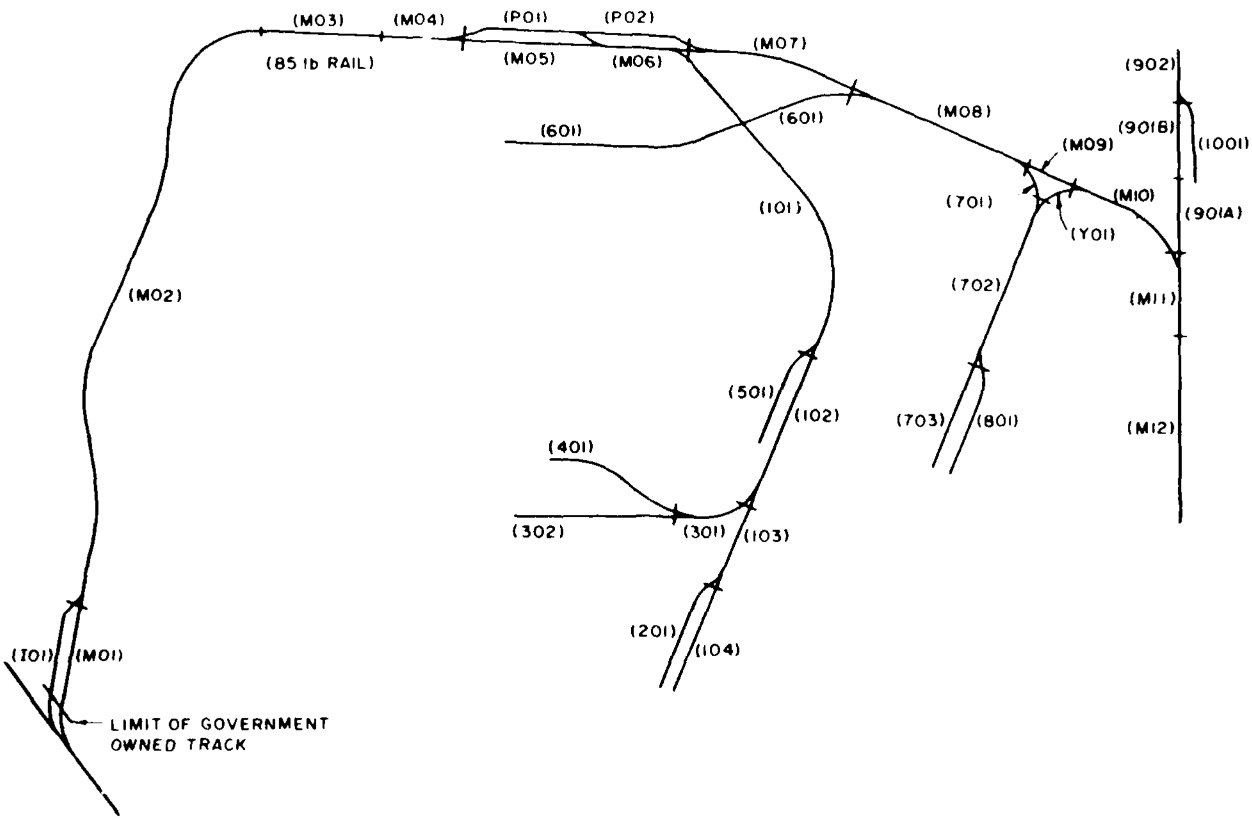


Figure 8. Track segment numbering sequence at Fort Example.

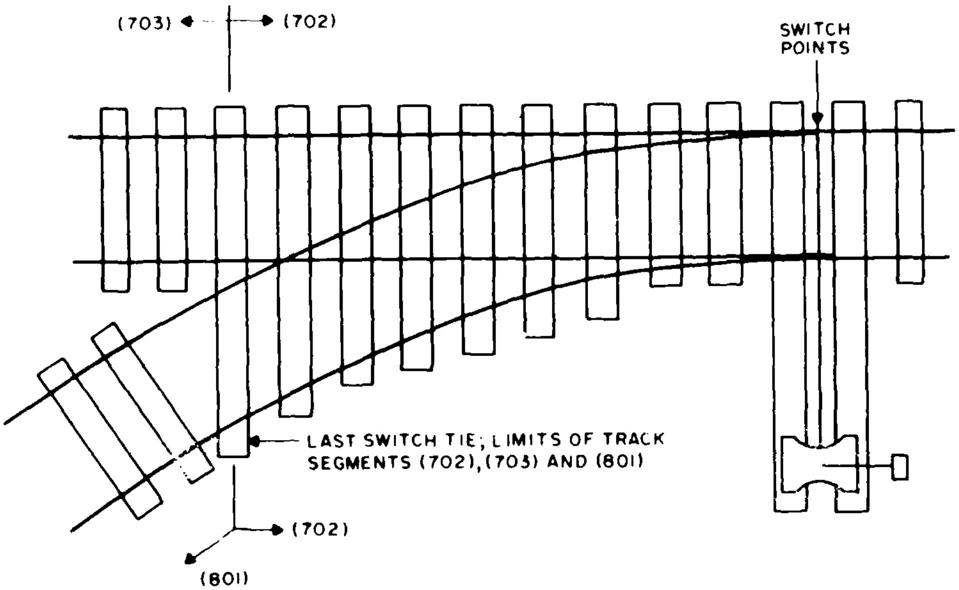
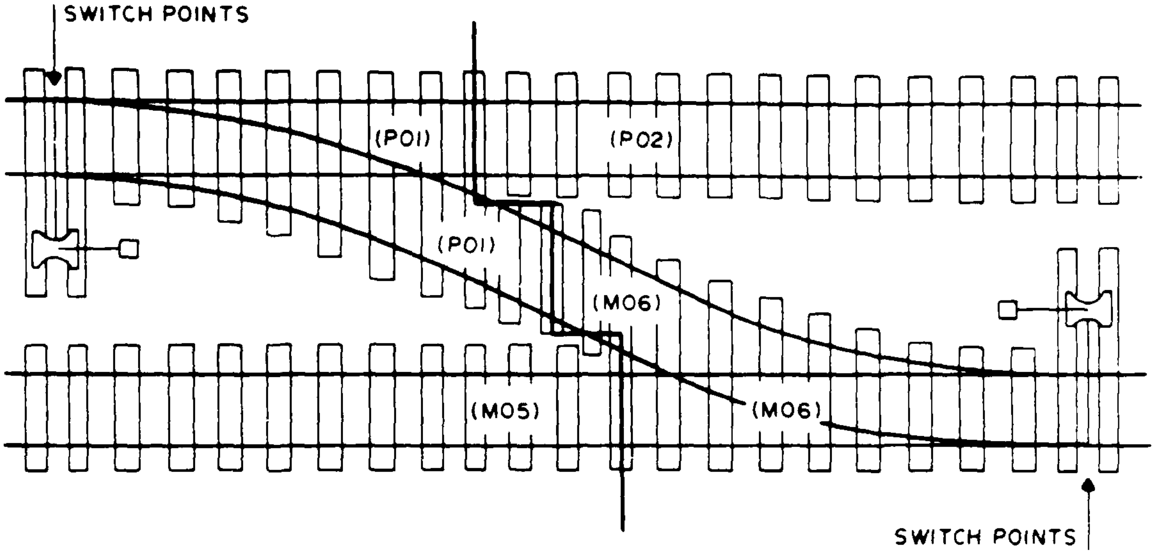
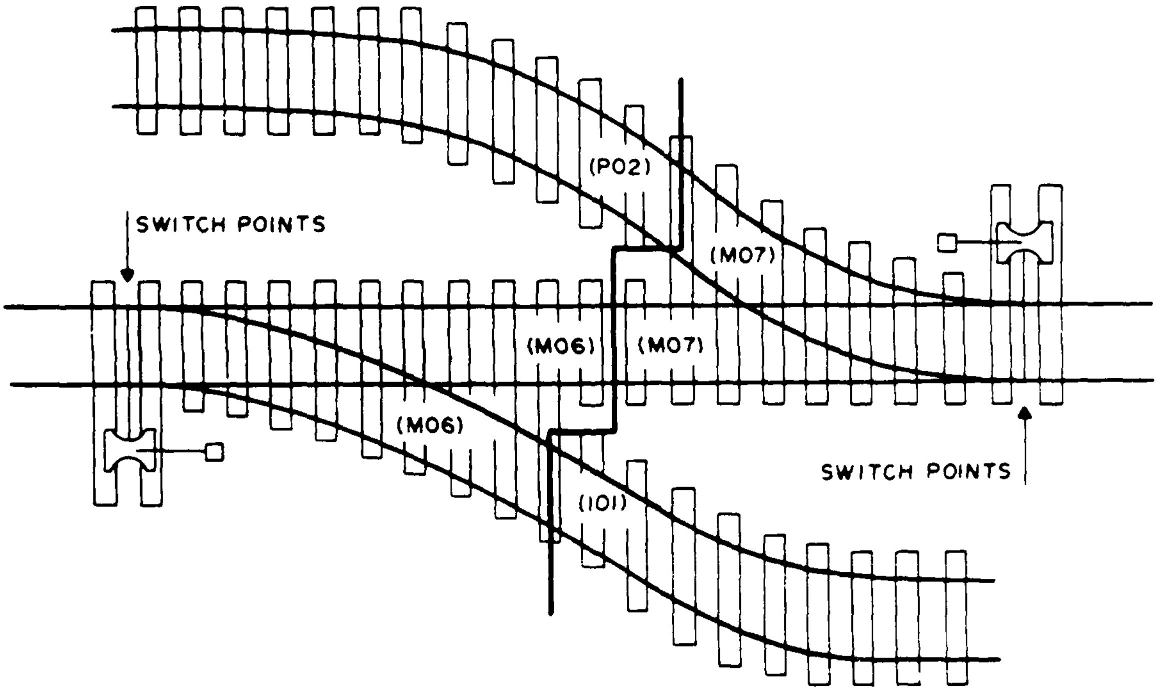


Figure 9. Track segmenting at a turnout—Fort Example.



SEGMENTING A CROSSOVER



SEGMENTING BACK TO BACK TURNOUTS

Figure 10. **Track segmenting at crossovers with back-to-back turnouts--Fort Example.**

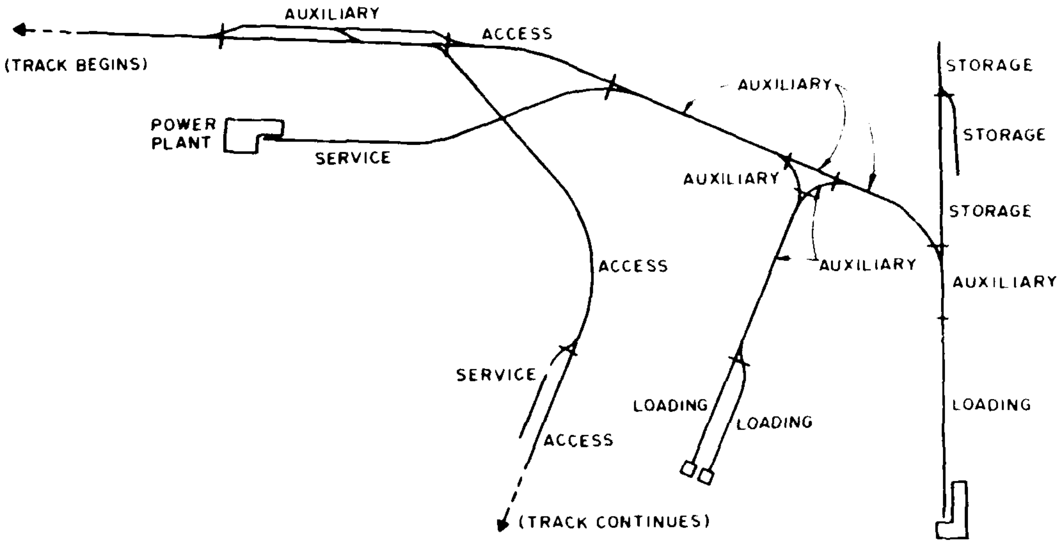


Figure 11. Track usage at Fort Example.

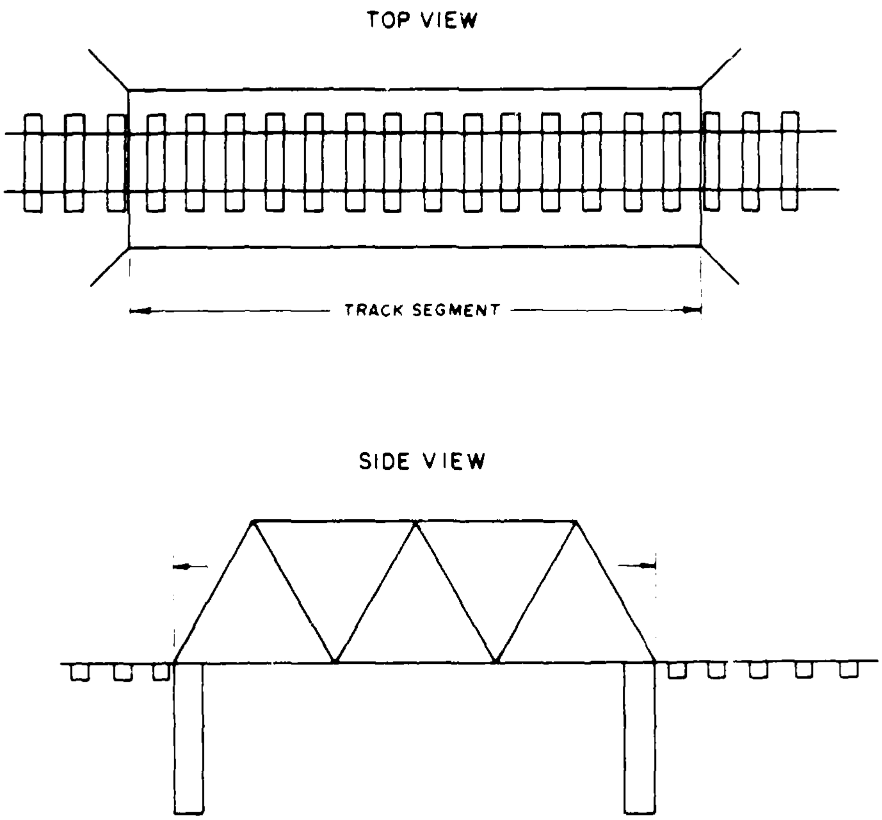


Figure 12. A bridge track segment.

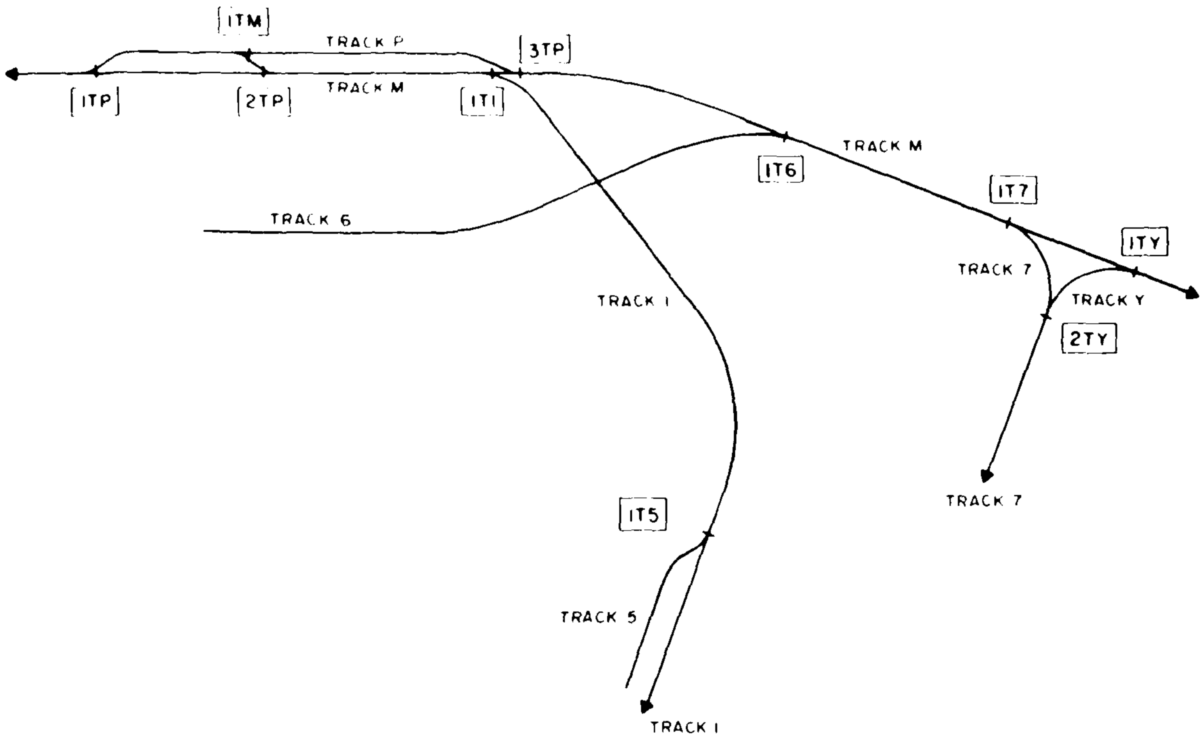


Figure 13. Turnout numbering at Fort Example.

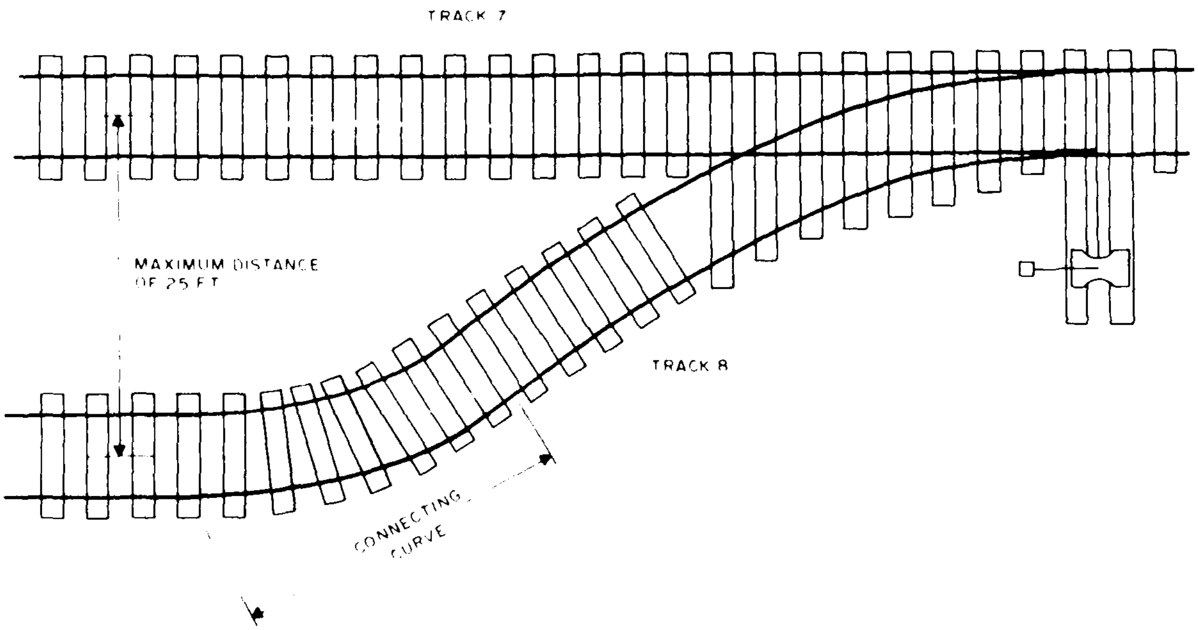


Figure 14. A connecting curve at Fort Example.

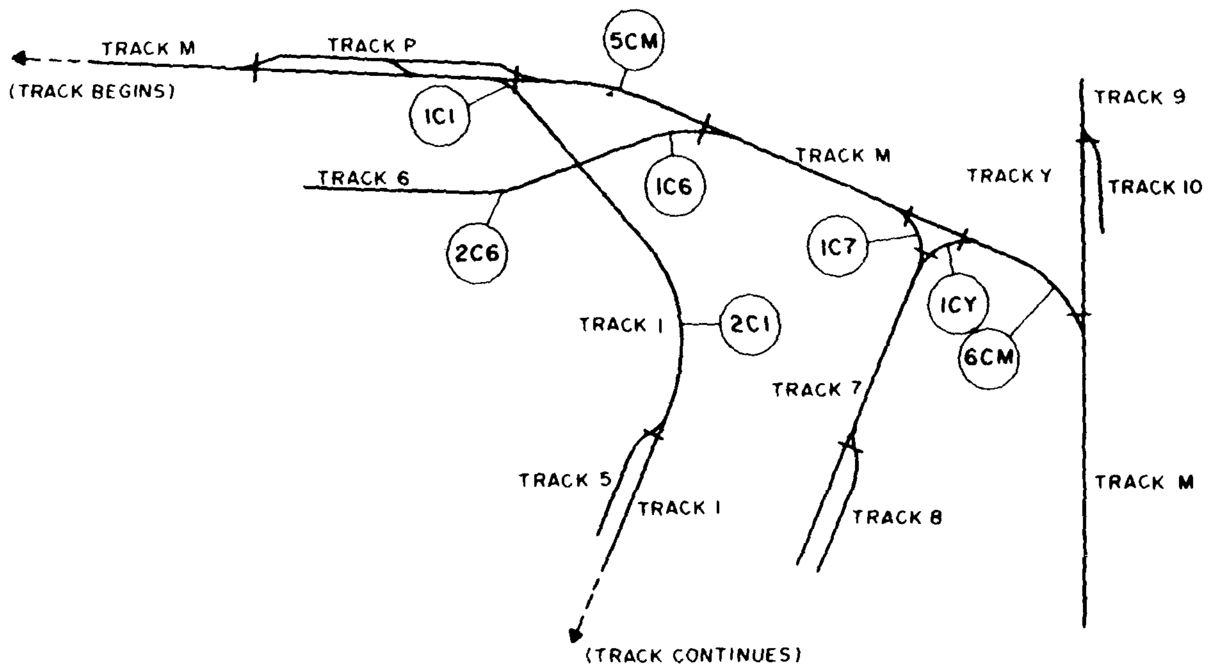


Figure 15. Curve numbering sequence at Fort Example.

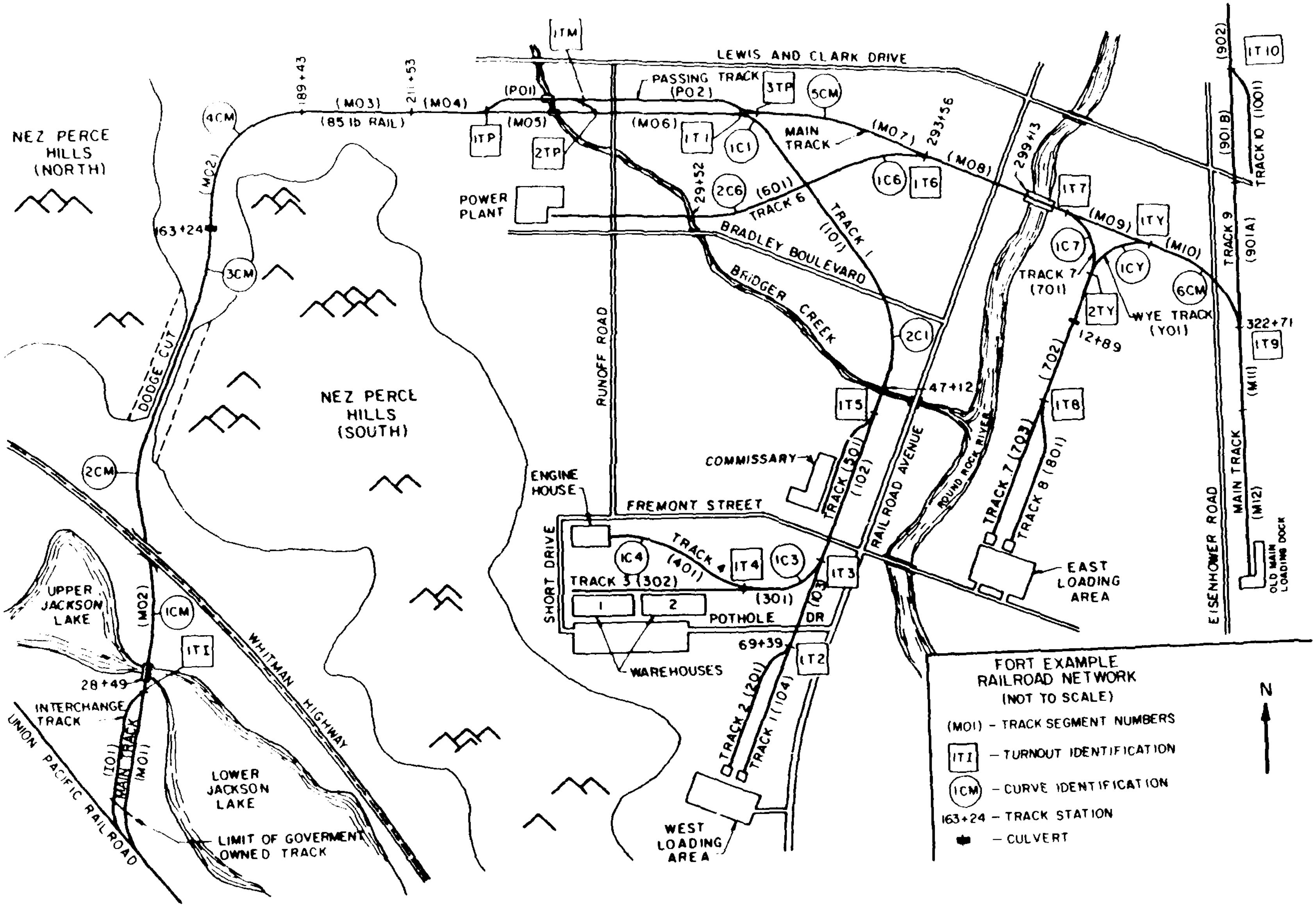


Figure 16. Fort Example railroad map.

3 INSTALLATION NETWORK INFORMATION

Overview

Installation Network Information includes all data items not directly associated with specific track segments. This information is indicated by the upper dark box of the RAILER database structure presented in Figure 1. As illustrated in Figure 17, Installation Network Information consists of four data groups. The individual data elements are listed in Table 1 and described below. Figure 18 shows a completed Installation Network Information data collection form for Fort Example. A blank form is included in Appendix A.

Data Element Descriptions

Installation Information

1. Installation Number

Description: A code that indicates the installation on which the network is located. The number is assigned by the Chief of Engineers to uniquely identify every Army real estate holding.

Purpose: The number will associate a network with one particular installation. It is also used in the assets accounting module of the IFS.

Possible sources: Real property records, IFS

Examples: 08005, 25145, 40755

2. Primary Installation Number

Description: This IFS data element is the number of the installation that has maintenance management responsibility for the site. Usually, the installation at which the network is located is responsible for its own maintenance management. When this is the case, then this data element and the previous one (Installation Number) are identical.

Purpose: This code correlates the installation with the supporting DEH organization. It is also used in the assets accounting module of IFS.

Possible sources: Real property records, IFS

Examples: 08005, 25145, 40755

Installation Information

3. Installation Name

Description:	The common name of the installation where the network is located. Only one installation name will be assigned to a network.
Purpose:	To identify the network's installation.
Possible sources:	Real property records, IFS
Examples:	Tooele Army Depot, Fort Devens, Fort Sill

4. State Code

Description:	The two-character state code where the installation is located.
Purpose:	To identify the state where the installation is located.
Possible source:	Mailing address of installation.
Examples:	OR, IL, NY

Installation Trackage (Multiple Data Elements)

5. Track Number

Description:	This element is a unique number for each track at the installation.
Purpose:	References the track in a way compatible with present systems and reports.
Possible sources:	Base maps, MTMC reports. Tracks not already assigned numbers will be numbered to be consistent with local conventions.
Examples:	M, 5, A2, 3B

6. Track Length

Description:	This element contains the length (in feet) of each track in the network.

Installation Trackage (Multiple Data Elements), Cont'd

Purpose:	Provides the total length of trackage under installation responsibility.
Possible source:	Field survey. Initial track length values are calculated by the RAILER computer program using track segment data. The user may override these values to account for conditions such as tracks ending at a turnout.
Examples:	35387, 865

7. Number of Segments

Description:	This element provides the number of track segments assigned to a specific track. There must be at least one segment for each track number.
Purpose:	Quantifies track segments, which are the basic management unit in the maintenance management system.
Possible sources:	Maps and field survey. The number of segments in each track is a summary data element calculated by the RAILER computer program using track segment data.
Examples:	12, 1

Installation Track Drawing Information (Multiple Data Elements)

8. Drawing Number

Description:	This IFS data element uniquely identifies any diagram associated with the installation track network. These diagrams may include track maps, track charts, and structural drawings.
Purpose:	An aid in locating track diagrams; also will be used in the assets accounting module of the revised version of IFS.
Possible sources:	Office records of inventory, IFS
Examples:	RRCHRT0023, UDNGIO4UTY

Installation Track Drawing Information (Multiple Data Elements), Cont'd

9. Drawing Title

Description:	This element is the title or a brief description of the drawing.
Purpose:	To identify and locate track diagrams appropriate for specific use
Possible sources:	Office records or inventory
Examples:	General Road and Railroad Map, Railroad Network Detail Sheet, Profile of Track M

Serving Railroad Information and Trackage

10. Company Name

Description:	This element displays the name(s) of the commercial railroad company (or companies) serving the installation.
Purpose:	To associate the serving railroad company with the network installation.
Possible sources:	Maps, company office, MTMC reports
Examples:	Southern Pacific, Sante Fe, Illinois Central Gulf

11. Company Code

Description:	This element lists the serving commercial railroad company's AAR Alpha Code reporting marks.
Purpose:	Further identification of the serving commercial railroad company. Within RAILER, this code is used to associate commercial trackage with the appropriate commercial railroad company.
Possible sources:	Literature, company office, MTMC reports
Examples:	SP, ATSF, ICG

12. Location of Nearest Mobilization-Capable Yard

Description: This element provides the geographic location of the nearest commercial yard that could support the installation's mobilization requirements in the event the installation network were not available.

Purpose: Will be used in the assets accounting module of IFS-M.

Possible sources: Maps, company office, MTMC reports, IFS

Examples: San Bernardino, CA; RF&P Potomac Yard

13. Direction of Nearest Mobilization-Capable Yard

Description: This element provides the compass direction of the nearest yard that could support the installation's mobilization requirements.

Purpose: Will be used in the assets accounting module of IFS-M.

Possible sources: Maps, MTMC reports, IFS

Examples: N, NE, NNE

14. Distance to Nearest Mobilization-Capable Yard

Description: This data element is the highway distance in miles to the nearest commercial railroad yard capable of supporting the installation's mobilization requirements. Care should be used in determining whether this value is greater than 25 miles.

Purpose: Distance is used as a factor in prioritizing railroad maintenance, repair, and construction projects. This data element will also be used in the assets accounting module of the forthcoming revised version of IFS.

Possible sources: Maps, MTMC reports, odometer readings, IFS

Examples: 10, 23, 27, 50

15. Track Designation

Description: This element is composed of various unique labels, as designated by the commercial company; labels characterize specific portions of track from the Strategic Rail Corridor Network (STRACNET) connection to the point of installation responsibility.

Purpose: Identification used by the serving railroad for inspection, maintenance, and operations. Use of commercial designation minimizes repetition and confusion when communicating with the commercial railroad.

Possible source: Company office

Examples: Fort Sill Lead, South Tooele Wye

16. Track Length

Description: This element provides the length of each track designation described above (to nearest tenth of a mile) from the point of installation responsibility to the nearest connection with STRACNET.

Purpose: Provides information on the serving railroad trackage required for military use.

Possible sources: Maps, company office, field measurement

Examples: 0.1, 7.2, 15.7, 118.5

17. Operation Capable

Description: This element is a YES or NO response indicating the ability of the serving railroad trackage to meet the installation's mobilization mission. Each track designation must be assessed. A YES response requires the track to be in, at least, FRA Class 1 condition.[7]

Purpose: Information is used as a factor in prioritizing installation railroad maintenance, repair, and construction projects based on track adequacy for mobilization.

Possible sources: MTMC reports, field survey, FRA reports, railroad company inspection and certification

Choices: No or Yes

[7] *Track Safety Standards* (Federal Railroad Administration Office of Safety, U.S. Department of Transportation, 1982); *Civil Rail Lines Important to National Defense* (Military Traffic Management Command, July 1986).

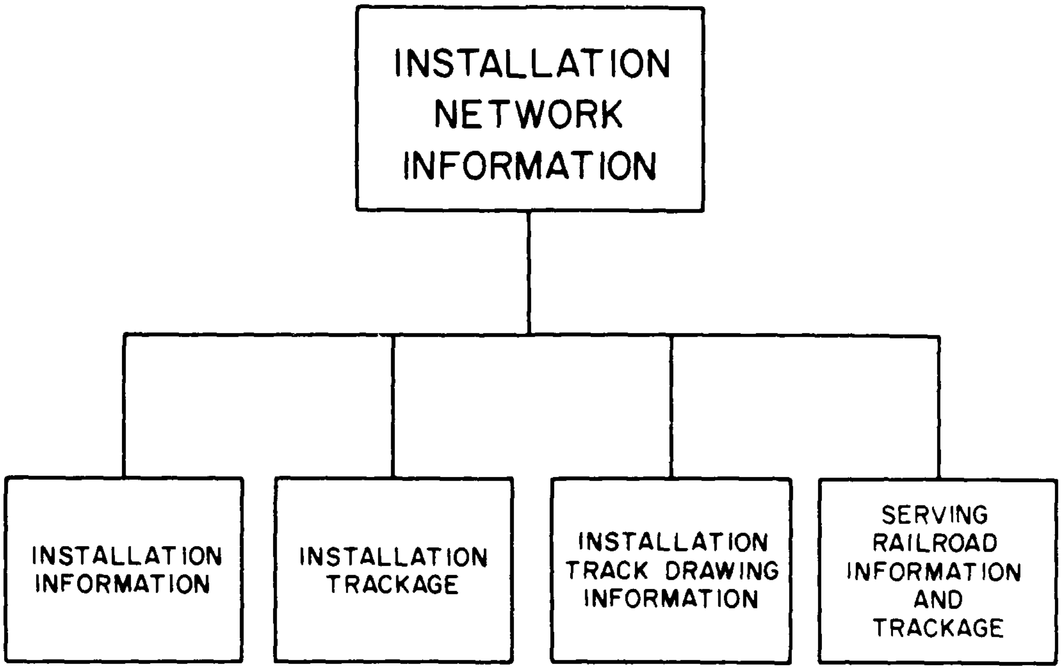


Figure 17. Installation network information database structure.

Table 1

Installation Network Information Data Elements

Installation Information

1. Installation Number
2. Primary Installation Number
3. Installation Name
4. State Code

Installation Trackage

5. Track Number
6. Track Length
7. Number of Segments

Installation Track Drawing Information

8. Drawing Number
9. Drawing Title

Serving Railroad Information

10. Company Name
11. Company Code
12. Location of Nearest Mobilization-Capable Yard
13. Direction of Nearest Mobilization-Capable Yard
14. Distance to Nearest Mobilization-Capable Yard
15. Track Designation
16. Track Length
17. Operation Capable

RAILER
INSTALLATION NETWORK INFORMATION

Date: 6-15-[illegible]

INSTALLATION INFORMATION

Installation Number	Primary Installation Number	Installation Name	State Code
EX 9EC	EX 213	FORT EXAMPLE	OR

SERVING RAILROAD(S) INFORMATION

Company Name	Company Code	NEAREST MOBILIZATION CAPABLE YARD		
		Location	Direction	Highway Distance (miles)
UNION PACIFIC RAILROAD	UP	EAST ORANGE	NW	45

SERVING RAILROAD TRACKAGE

Company Code	Track Designation	Track Length (miles)	Operation Capable
UP	FT. E. LEAD	0.1 MILES	N Y
UP	FT. E. INTERCHANGE	0.1 MILES	N Y

INSTALLATION TRACK DRAWINGS

Drawing Number	Drawing Title

INSTALLATION TRACKAGE

Track Number	Track Length (feet)	Number of Segments	Track Number	Track Length (feet)	Number of Segments	Track Number	Track Length (feet)	Number of Segments
1	7887	4	7	3515	3	M	35397	12
2	1095	1	8	1477	1			
3	1386	2	9	3255	3			
4	593	1	10	1427	1			
5	865	1	I	2691	1			
6	4717	1	P	4444	2			

Figure 18. Completed installation network information form for Fort Example.

4 TRACK SEGMENT INVENTORY INFORMATION

Overview

As discussed in Chapter 2, track segments are the basic maintenance management unit within RAILER. Track Segment Inventory Information includes design data and other relatively permanent physical characteristics of the railroad right-of-way. Within the RAILER database structure, this information is indicated by the lower dark box in Figure 1. As illustrated in Figure 19, Track Segment Inventory Information consists of nine data groups. The individual data elements are listed in Table 2 and described below. A completed Track Segment Inventory Information data collection form for Fort Example is presented in Figure 20. Note that for convenience, Grade Crossing and Rail Crossing information is collected in the same area of the form. A blank Track Segment Inventory Information form is included in Appendix A.

Data Element Descriptions

Segment Identification

---

1. Track Segment Number

Description:	This element is the alphanumeric code assigned for track segment identification. As discussed in Chapter 2, it is created by adding a two- or three-digit alphanumeric suffix to the track number. The track segment number must not exceed eight digits.
Purpose:	Represents the basic maintenance management unit for which inventory data will be collected and stored in the database.
Possible sources:	Maps and field survey
Examples:	M11, P02, 501, 901A

2. Beginning Location

Description:	This element is the track location marking the beginning of the track segment.
Purpose:	Identifies the location of the track segment in relation to the specific track.
Possible source:	Field survey
Examples:	322+71, 19+10

3. End Location

Description: This element is the track location marking the end of the track segment.

Purpose: Used in conjunction with the beginning location to determine the length of the track segment and hence the track (in feet).

Possible source: Field survey

Examples: 330+00, 43+66

4. Track Category

Description: This element is entered as "A," "B," or "C" and indicates the track segment's operational status. "A" is reserved for main lines and other active segments where the operating speed exceeds 10 mph. "B" indicates all other active track and tracks with a foreseeable need. "C" represents all inactive track with no current mission requirements.

Purpose: Useful in planning maintenance and repair projects and designating critical trackage.

Possible sources: Installation Transportation Office (ITO), MTMC-TEA installation TSCS.

Choices: A, B, or C

5. Track Use

Description: This element identifies the primary function of the track segment as described in Chapter 2.

Purpose: Used for prioritizing railroad track maintenance, repair, and construction projects.

Possible sources: ITO, MTMC-TEA installation TSCS, field survey.

Choices: Acc-ACCESS, Aux-AUXILIARY, L-LOADING, Se-SERVICE, St-STORAGE.

6. Track Rank

Description: This element is a number reflecting the relative importance, on a scale from 0 to 1.0, of the current track segment to other track segments. Recommended track rank procedures for FORSCOM installations are presented in the RAILER I Technical Report.[8] For non-FORSCOM installations, the track rank can be applied subjectively.

Purpose: Used for prioritizing track maintenance, repair, and construction projects.

Possible sources: Mathematical calculation, MTMCTEA installation TSCS (potentially in the future), subjective opinion.

Examples: .94, .26, .03

7. Construction Code

Description: This IFS data element indicates the permanence of the track segment.

Purpose: Useful in formulating long-term maintenance plans. Also will be used in the assets accounting module of IFS-M.

Possible sources: Real property records, IFS

Choices: P-Permanent, S-Semipermanent, T-Temporary, or L-Leased

8. Preceding Track Segment Number(s)

Description: This element is the immediate preceding track segment that a train must pass in order to access the given track segment identified in No. 1 above as the train *enters* the installation. Figure 21 shows preceding track segments for several Fort Example track segments.

Purpose: Used to prioritize track segment maintenance, repair, and construction projects.

[8] D. R. Uzarski, D. E. Plotkin, and D. G. Brown, *The RAILER System for Maintenance Management of U.S. Army Railroad Networks: RAILER I Description and Use*, Draft Technical Report (USA-CERL, February 1988).

Segment Identification, Cont'd

Possible sources:	Maps and field survey
Examples:	M10, P01, 101, M11

9. Comments

Description:	This element provides space for written comments, if necessary.
Purpose:	Clarification of track segment identification data elements.
Possible sources:	Maps and field survey
Example:	Track segment inaccessible because of paved-over road crossing.

Track Structure (Could Be Multiple)

10. Beginning Location

Description:	This element is the (beginning) track location for any significant change in one or more track structure characteristics (inventory items 11 through 21), such as rail weight and/or section. The first track structure beginning location is always equal to the track segment beginning location.
Purpose:	Permits the user to easily locate all instances of a given track characteristic (such as 70-lb rail or gauge rods), and determine the amounts of various track materials (such as ties or 90-lb rail).
Possible source:	Field survey. For changes in rail weight/section, the beginning station will be the average station between the opposite, but staggered, compromise joints. See Figure 22.
Examples:	189+43, 211+53

11. Rail Weight

Description:	This element describes the weight of the rail in pounds per yard.
Purpose:	Used in structural evaluation, maintenance planning, and rail replacement studies for lightweight rail.

Possible sources: Field survey and office records. Weight information is rolled into the rail web during rail manufacture (Figure 23). The rail weight should be determined from a rail as close as possible to the beginning of the track segment. If different rail weights are present, all should be inventoried. Changes in rail weight can be determined by looking for compromise joints (Figures 24 and 25) or for locations where standard joints have been forced to fit rails of different weight or section. Weight can then be determined by examining the rail markings on either side of the joint. If markings are impossible to read due to rust, etc., even after wire-brushing, the weight can be estimated by measuring the width of the base, width of the head, and the height of the rail. Appendix B provides a table of standard dimensions for rails of different weight and section.

Examples: 75, 90, 100

12. Rail Section

Description: This element refers to the specific design of the rail cross section.

Purpose: Useful in maintenance planning.

Possible source: Field survey. Rail section (like rail weight) is embossed on the rail during manufacture, or can be determined from measurements using the chart in Appendix B. (See above discussion of possible sources for rail weight.)

Examples: RE, AS, 10025

13. Tie Plate Length

Description: This element is the length of the plate in inches. Figure 26 illustrates this measurement. The size of the plate normally varies with rail weight.

Purpose: Provides information for use in maintenance planning.

Possible source: Field survey

Examples: 10, 12

14. Tie Plate Shoulder

Description:	This element reflects the type of plate. Plates are either single-shouldered, double-shouldered, or have no shoulders (Figure 27). This element is also used to indicate the absence of tie plates.
Purpose:	Provides information for maintenance planning.
Possible source:	Field survey
Choices:	SS-Single Shoulder, DS-Double Shoulder, NS-No Shoulder, NO-No Plates (if plates not used)

15. Rail Anchors

Description:	This element is a yes/no response indicating if rail anchors are present. Figure 28 shows rail anchors.
Purpose:	Provides information for maintenance planning.
Possible source:	Field survey
Choices:	N-No or Y-Yes

16. Gauge Rods

Description:	This element is a yes/no response indicating if gauge rods are present. Figure 29 shows gauge rods.
Purpose:	Provides information for maintenance planning.
Possible source:	Field survey
Choices:	N-No or Y-Yes

17. Tie Cross Section

Description:	This element provides a tie's cross sectional dimensions in inches (Figure 30).
Purpose:	Used in maintenance planning. Also an important element in structural evaluation.

Possible source: Field survey. Ties should be spot-checked throughout the track segment (Figure 31). Because tie depth often is difficult to measure, it should be verified only where practical.

Examples: 6x8, 7x9

18. Tie Quantity

Description: This element gives the number of ties per 200 ft of track.

Purpose: Used to determine average tie spacing, which is important for compliance with maintenance standards and for structural evaluation.

Possible source: Field survey on a sampling basis. Count the ties between established 200-ft station points.

Examples: 120, 131

19. Tie Material Type

Description: This element lists the kind of material used in the tie (usually wood). Wood types, if known, can be reported.

Purpose: Provides information useful in maintenance planning. Also useful for structural evaluation.

Possible source: Field survey

Examples: Concrete, wood, oak

20. Support Ballast Depth

Description: "Support ballast" is the ballast below the bottom of the tie and above the top of the subgrade. This element provides the average depth (in inches) of the support ballast (Figure 32).

Purpose: Provides essential information for structural evaluation.

Possible source: Field survey. These data are collected on a sampling basis by digging test pits or through penetrometer testing. Measurements should be taken as close as possible to a rail/tie interface.

Examples: 8, 12

Track Structure (Could Be Multiple), Cont'd

21. Ballast Type

Description:	This element lists the kind of material comprising the ballast.
Purpose:	Provides information for maintenance planning.
Possible source:	Field survey
Examples:	Slag, crushed rock, gravel, granite

22. Comments

Description:	This element provides space for comments, if necessary.
Purpose:	Clarification of track structure data element information.
Possible source:	Field survey
Examples:	65-lb weight estimated because markings obscured by corrosion. Gauge rods installed between stations 12+50 and 15+00 at 50-ft intervals.

Turnouts (Could Be Multiple)

23. Turnout Identification Number

Description:	This element is the identifying number assigned to the turnout as described in Chapter 2.
Purpose:	Provides individual identification for each specific turnout. Required for easy reference in maintenance management.
Possible sources:	Maps, field survey, and office records.
Examples:	2TP, 1T7

24. Switch Point Location

Description: This element is the track location where the point of switch occurs (Figure 33).

Purpose: Serves as an identifier for turnout location within the segment. Useful in management.

Possible sources: Maps and field survey

Examples: 251+40, 309+11

25. Direction

Description: This element describes whether the turnout diverges to the left (left-handed), right (right-handed), or in both directions (equilateral). Figures 34 and 35 illustrate turnout direction.

Purpose: Useful in maintenance planning.

Possible sources: Field survey, maps, office records

Choices: LH, EQ, RH

26. Point Length

Description: This element describes switch point length in linear feet to the nearest half-foot. Figure 36 shows how to measure this element.

Purpose: Useful in maintenance planning.

Possible sources: Field survey and office records.

Examples: 13, 15

27. Rail Weight

Description: This element describes the weight of rail in pounds per yard. Refer to the discussion of rail weight under data element 11 above for a more complete description.

Purpose: Indicates rail weight within the turnout. Often this weight differs from the weight of rail in the segment itself.

Possible sources: Field survey and office records

Examples: 90, 110

28. Frog Type

Description: This element describes the kind of frog used. Figures 37 through 40 illustrate the various frogs in use.

Purpose: Useful in maintenance planning.

Possible sources: Field survey and office records

Choices: B-Bolted, SG-Self-Guarded, RBM-Rail-Bound Manganese, Sp-Spring

29. Frog Size

Description: This element is the frog size number. Figure 41 illustrates the frog size concept.

Purpose: Useful in operations and maintenance planning.

Possible sources: Field survey and office records. Figure 42 shows how the field measurement is performed.

Examples: 8, 10

30. Guard Rail Length

Description: This element describes the length of the guard rails in linear feet.

Purpose: Useful in maintenance planning. If there are no guard rails because the frog is self-guarded, this element may be left blank.

Possible sources: Field survey and office records. Figure 43 shows how the measurement is performed.

Examples: 11, 13

Turnouts (Could Be Multiple), Cont'd

31. Comments

Description: This element provides space for comments, if necessary.

Purpose: Clarifies turnout data element information.

Possible source: Field survey

Example: Turnout completely rebuilt in 1976.

Curves (Could Be Multiple)

32. Curve Identification Number

Description: This element is the assigned identifying number for the curve. At present, curves are not numbered at the installations. Each curve in the track network should be assigned a specific number as described in Chapter 2.

Purpose: Provides individual identification for each curve. Required for easy reference in maintenance management.

Possible sources: Maps and field survey

Examples: 3CM, 2C6

33. Curvature

Description: This element is the amount of curvature for the curve measured in degrees.

Purpose: Important for determining train operations, especially when tight curves and long cars are involved. Additionally, this measurement provides the basis for determining deviations, through inspection, of the track curvature. Combined with speed to determine superelevation.

Possible sources: Actual designed curvatures from records are preferred. If not available, the average of several string line measurements taken in the field well within the curve may be substituted. In a string line measurement, a chord of the curve along one rail is established with a taut 62-ft string. The curvature is then approximated by the distance in inches between the midpoint of the chord and the rail. Four views of this measurement process are presented in Figure 44. For more details, see Hay,[9] pp 611-612. The average measurement should be rounded to the nearest 1/2 degree.

Examples: 3, 5,

34. Superelevation

Description: This element is the design or required superelevation of the curve measured to the nearest quarter inch.

Purpose: Curve superelevation and degree of curvature together determine the maximum safe train operating speed on the curve. This data element is also used to calculate deviations from track geometry inspection data.

Possible sources: Acutal design superelevation from records is preferred. This value can then be used in RAILER to calculate the safe operating speed (inventory data element 35). Otherwise, an estimated superelevation value is calculated within RAILER, based on data elements 33 and 35. The relationship between operating speed, superelevation, and curvature is specified in Table 3.

Examples: 0.00, 1.25, 2.50, 4.00

35. Maximum Speed

Description: This element is the maximum safe or desired operating speed on the curve, in mph.

Purpose: If a design superelevation is entered for data element 34, then a safe maximum operating speed (data element 35) can be calculated using RAILER. Otherwise, a maximum operating speed is entered for data element 35; this value is then used in RAILER to calculate the required superelevation (data element 34). The relationship between operating speed, superelevation, and curvature is specified in Table 3.

[9] W. W. Hay, *Railroad Engineering*, 2nd Ed. (John Wiley and Sons, New York, 1982).

Curves (Could Be Multiple), Cont'd

Possible source:	ITO and installation train operators if not calculated using RAILER.
Examples:	25, 20

36. Comments

Description:	This element provides space for comments, if necessary.
Purpose:	Clarification of curve data element information.
Possible source:	Field survey
Example:	Curvature data based on string line measurements.

Grade Crossings (Could Be Multiple)

A grade crossing is a point at which any significant portion of the track structure is deliberately covered to permit access by vehicular or foot traffic across the rail head. Road crossings are the most common type of grade crossing. Grade crossings also include (but are not limited to) tank trails, built-up foot trails, fills adjacent to loading docks for truck access, marshaling areas, and entire streets with tracks down their length.

37. Road Name/Crossing Identity

Description:	This element identifies the vehicle or foot path or access purpose associated with the grade crossing. If the grade crossing is a road crossing, this is the name of the street or road.
Purpose:	Serves as an identifier for easy reference in maintenance management.
Possible sources:	Field survey, installation maps, community maps
Examples:	Bradley Boulevard, north tank trail, East dock of W.H. 2.

38. Centerline Location

Description: This element is the track location of the crossing centerline (Figure 45).

Purpose: Specifies the location where the track and road (or path) meet. Serves as an identifier for management. This information is especially important if the same road crosses a track segment more than once.

Possible sources: Maps, field survey

Examples: 13+07, 253+14

39. Road Crossing Identification Number

Description: This element lists any identification number that may be assigned. If a Department of Transportation (DOT) identification number has been assigned, it should be listed. Generally, this requirement will apply only to off-base road crossings.

Purpose: Provides further information about road crossings.

Possible sources: Field survey, office records. DOT numbers usually are mounted on the post of the protection device (Figure 46).

Example: 115760

40. Crossing Length

Description: This element lists the length of the crossing, in linear feet, measured along the centerline of the track (Figure 47).

Purpose: Useful in maintenance planning. Also used in RAILER to adjust and qualify track inspection results.

Possible sources: Field survey and office records

Examples: 4, 30, 425

41. Crossing Type

Description: This element describes the crossing material used. Figures 48 through 53 show various crossing types.

Purpose: Useful in maintenance planning.

Possible sources: Field survey and office records

Examples: Timber, rubber, asphalt, gravel, concrete, timber/asphalt

42. Protection

Description: This element describes the kind of protection devices present or flags their absence. Figures 54 through 56 show various protective devices.

Purpose: Information useful in maintenance and safety planning.

Possible sources: Field survey and office records

Choices: G-Gates, F-Flashers, S-Signs, N-None

43. Bolted Joints

Description: This element indicates if the rail joints in a grade crossing are bolted.

Purpose: To assist in locating rail joints in road crossings for replacement.

Possible source: Field survey

Choices: N-No or Y-Yes

44. Comments

Description: This element provides space for comments, if necessary.

Purpose: Clarification of grade crossing data element information.

Possible source: Field survey

Example: Lewis and Clark crossing paved over--track unusable.

Rail Crossings (Could Be Multiple)

45. Crossing Segment Number

Description:	This element is the identification number of the crossing track segment.
Purpose:	Provides a cross reference for crossing track segments.
Possible sources:	Maps, field survey
Examples:	601, 101

46. Centerline Location

Description:	This element is the track location where the centerline of the crossing track crosses (Figure 57).
Purpose:	Identifies location of track segment crossings. Provides a cross reference for location.
Possible sources:	Maps, field survey
Examples:	12+29, 16+38

47. Rail Weight

Description:	This element describes the rail weight in pounds per yard.
Purpose:	Indicates the weight of rail used in the crossing. This rail weight may differ from that indicated in track structure.
Possible sources:	Field survey and office records
Examples:	90, 110

48. Frog Type

Description:	Each rail crossing includes four frogs. This element describes the kind of frog used. Figures 58 through 60 illustrate the various frog types in use.
Purpose:	Useful in maintenance planning.

Rail Crossings (Could Be Multiple), Cont'd

Possible sources: Field survey and office records

Choices: B-Bolted, MI-Manganese Insert, SM-Solid Manganese

49. Crossing Angle

Description: This element is the acute or right angle, in degrees, formed by crossing track segments (Figure 61).

Purpose: Useful in maintenance planning.

Possible sources: Field survey and office records

Examples: 60, 90

50. Comments

Description: This element provides space for comments, if necessary.

Purpose: Clarification of rail crossing data element information.

Possible source: Field survey

Example: Crossing replaced in 1976.

Clearance Restrictions and Related Facilities

A clearance restriction is an object that presents a potential restriction on train operations because of its proximity to the railroad right-of-way. For example, a wall parallel to the track may prevent passage by some car types and/or access by personnel. Related facilities have an auxiliary support relationship to the track segment: examples include ramps, docks, lighting equipment, and marshaling yards. Clearance restrictions and related facilities are addressed together here because of their common auxiliary relationship to the track and because ramps and docks are the most common examples of both.

51. Classification

Description: This element specifies whether the object is a clearance restriction, a related facility, or both.

Purpose: Permits the user to distinguish between clearance restrictions and related facilities.

Possible sources: Field survey.

Choices: CR-Clearance Restriction and/or RF-Related Facility

52. Beginning Location

Description: This element describes the track location where a clearance restriction and/or related facility begins.

Purpose: Important for train operations. Also useful in maintenance planning.

Possible sources: Field survey, maps

Examples: 45+00, 231+67

53. End Location

Description: This element describes the track location where either a clearance restriction and/or related facility ends.

Purpose: Important for train operations. Also useful in maintenance planning.

Possible sources: Field survey, maps

Examples: 35+10, 44+37

54. Obstruction and/or Facility Type

Description: This element describes the nature of a clearance restriction. Docks and ramps are indicated by "D" and "R," respectively.

Purpose: Identifies the object and explains why the clearance restriction exists. Important for train operations and in planning M&R projects.

Possible sources: Field survey, maps

Examples: D, R, Bridge Structure, Lighting

Clearance Restrictions and Related Facilities, Cont'd

55. Horizontal Measurement

Description:	This element provides the actual distance in feet from the inside (gauge) side of the rail head to a horizontal obstruction (Figure 62).
Purpose:	Useful in planning train operations and M&R projects for which realignment is considered.
Possible source:	Field survey
Examples:	5.0, 8.3

56. Vertical Measurement

Description:	This element provides the actual distance in feet from the top of the rail to the vertical obstruction or restriction. Vertical restrictions include the loading surfaces of docks and ramps which must align with the decks of boxcars and flatcars. Figure 63 shows how to measure a vertical restriction.
Purpose:	Information useful in planning train operations and in planning M&R projects for which raising the tracks is being considered.
Possible source:	Field survey
Examples:	18.0, 19.6

57. Facility Number

Description:	This element consists of the assigned IFS facility number of the related facility. Related facilities such as lights and ramps are often attached to buildings; if these attached facilities do not have their own IFS facility number, then the IFS facility number of the building should be used. If a facility number does not exist for a freestanding facility, NONE shall be reported as the facility number.
Purpose:	Serves as an identifier for managing facilities that the track segment directly serves. Also provides a cross reference into the IFS system.
Possible sources:	Maps, IFS, real property records, office records
Examples:	3426, 7435, NONE

Clearance Restrictions and Related Facilities, Cont'd

58. Loading Facility Capacity

Description: For loading docks, this element is the number of boxcar loading positions. For ramps, it is the length (in feet) of the tangent track abutting the ramp.

Purpose: Useful in maintenance planning and prioritization by quantifying the potential of loading tracks. This data element is used in the track rank (element 6) calculating procedures recommended for FORSCOM installations and presented in the RAILER I technical report.[10]

Possible sources: Field survey, ITO.

Examples: 4 (boxcar positions), 845 (tangent track length)

59. Comments

Description: This element provides space for comments when necessary.

Purpose: Clarification of clearance restriction and related facility data element information.

Possible source: Field survey

Example: Loading ramp is portable. Restriction is on inside of curve 2C1.

Drainage Structures (Could Be Multiple)

60. Centerline Location

Description: This element is the track location where the centerline of the drainage structure crosses the track centerline (Figure 64).

Purpose: Serves as a location identifier for the drainage structure within the segment. Useful in management.

Possible sources: Maps, field survey

Examples: 47+41, 246+01

[10] D. R. Uzarski, D. E. Plotkin, and D. G. Brown.

Drainage Structures (Could Be Multiple), Cont'd

61. Type

Description:	This element describes the kind of drainage structure.
Purpose:	Useful for drainage studies and maintenance planning.
Possible sources:	Field survey, office records
Examples:	Box culvert, drop inlet, storm sewer outlet

62. Size

Description:	This element is the cross sectional dimension(s) of the drainage structure in inches. If the structure has a circular or square cross section, then only one dimension is required. For other cross sections (i.e., oval or rectangular), both height and width dimensions are required. Size measurements are illustrated in Figure 65. If it is not possible to determine the internal size of the structure, the size of the opening may be used as a substitute; the use of this option should be indicated in the comments field.
Purpose:	Drainage structure size is useful in assessing drainage related to the track's operating environment.
Possible sources:	Field survey, office records
Examples:	24, 36 x 48

63. Material

Description:	This element describes the kind of material used to construct the drainage structure.
Purpose:	Useful in drainage studies and maintenance planning.
Possible sources:	Field survey, office records
Examples:	Concrete, corrugated metal pipe (CMP)

64. Comments

Description:	This element provides space for comments, if necessary.

Drainage Structures (Could Be Multiple), Cont'd

Purpose: Clarification of drainage structure data element information.

Possible source: Field survey

Examples: Bridger Creek; measurement is of cover grate.

Bridges (Could Be Multiple)

65. Facility Number

Description: This element is the full facility (identification) number as carried in the IFS.

Purpose: Provides individual identification of each bridge. Provides a cross reference to IFS.

Possible sources: Maps, IFS, facility records

Examples: BRG081, BRG021

66. Beginning Location

Description: This element is the track location where the bridge deck begins. Associated with the beginning and end of the deck are two station numbers; this element is the lower of these two values. See Figures 66 and 67.

Purpose: Serves as a location identifier for the bridge within the track segment.

Possible sources: Maps, field survey

Examples: 28+49, 299+13

67. End Location

Description: This element is the track location where the bridge deck ends. Associated with the beginning and end of the deck are two station numbers; this element is the higher of these two values (Figure 66).

Purpose: Used in determining bridge length for planning track maintenance over bridges.

Possible sources: Field survey

Examples: 30+69, 302+78

68. Ballasted

Description: This element is a yes/no response indicating whether the bridge deck is ballasted. Two types of nonballasted decks are presented in Figure 68; a ballasted bridge is depicted in Figure 69.

Purpose: Information useful in planning ballast and tie requirements at bridges.

Possible source: Field survey

Choices: N-no or Y-yes

69. Construction Type

Description: This element describes the material and design of the bridge.

Purpose: Information useful in coordinating maintenance planning for the bridge with that for the trackage.

Possible source: Field survey

Examples: Wood trestle, steel truss, concrete and steel plate girder

70. Comments

Description: This element provides space for comments, if necessary.

Purpose: Clarification of bridge data element information.

Possible source: Field survey

Example: Crosses Jackson Lake.

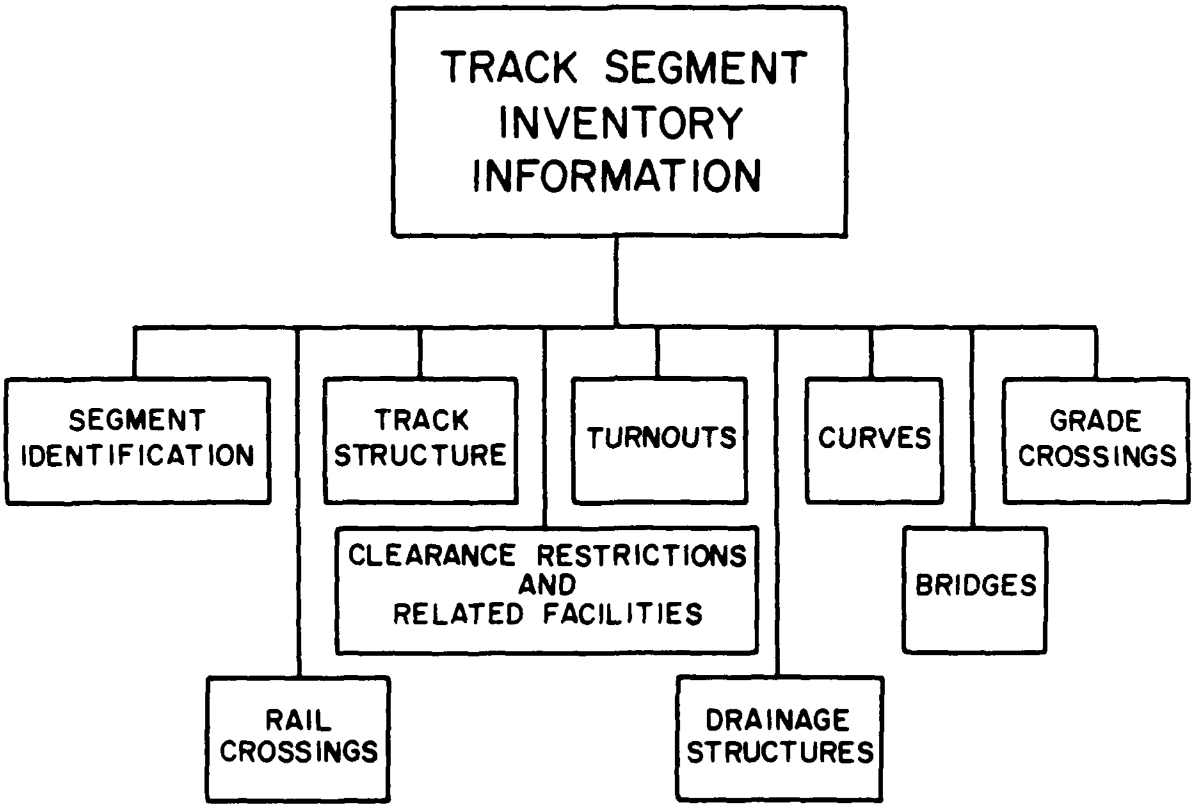


Figure 19. Track segment inventory database structure.

Table 2

Track Segment Inventory Data Elements

Segment Identification

1. Track Segment Number
2. Beginning Location
3. End Location
4. Track Category
5. Track Use
6. Track Rank
7. Construction Code
8. Preceding Segment Number(s)
9. Comments

Track Structure

10. Beginning Location
11. Rail Weight
12. Rail Section
13. Tie Plate Length
14. Tie Plate Shoulder
15. Rail Anchors
16. Gauge Rods
17. Tie Cross Section
18. Tie Quantity
19. Tie Material Type
20. Support Ballast Depth
21. Ballast Type
22. Comments

Turnouts

23. Turnout Identification Number
24. Switch Point Location
25. Direction
26. Point Length
27. Rail Weight
28. Frog Type
29. Frog Size
30. Guard Rail Length
31. Comments

Curves

32. Curve Identification Number
33. Curvature
34. Superelevation
35. Maximum Speed
36. Comments

Grade Crossings

37. Road Name/Crossing Identity
38. Centerline Location
39. Road Crossing Identification Number
40. Crossing Length
41. Crossing Type
42. Protection
43. Bolted Joints
44. Comments

Rail Crossings

45. Crossing Segment Number
46. Centerline Location
47. Rail Weight
48. Frog Type
49. Crossing Angle
50. Comments

Clearance Restrictions and Related Facilities

51. Classification
52. Beginning Location
53. End Location
54. Obstruction/and or Facility Type
55. Horizontal Measurement
56. Vertical Measurement
57. Facility Number
58. Loading Facility Capacity
59. Comments

Drainage Structures

60. Centerline Location
61. Type
62. Size
63. Material
64. Comments

Bridges

65. Facility Number
66. Beginning Location
67. End Location
68. Ballasted
69. Construction Type
70. Comments

TRACK SEGMENT # [illegible]
INSTALLATION NAME [illegible]

RAILER
TRACK SEGMENT INVENTORY INFORMATION

DATE [illegible]

SEGMENT IDENTIFICATION

Begin Location (station)	End Location (station)	Track Category	Track Use	Track Rank	Construction Code	Preceding Track Segment Number(s)	Comments
[illegible]	57+[illegible]	A B C	Acq Aux L Se St	C.C	D S T L	V[illegible]	

TRACK STRUCTURE

Begin Location (station)	RAIL Weight (lbs/yd)	RAIL Section	TIE PLATE Length (inches)	TIE PLATE Shoulder	RAIL ANCHORS	GAUGE RODS	TIES Cross Section (in x in)	TIES Quantity #/200TF	TIES Material Type	BALLAST Support Depth (inches)	BALLAST Type
[illegible]	[illegible]	A[illegible]	[illegible]	SS DS NS NO	N Y	N Y	7 x 9	[illegible]	WOOD	14	[illegible]
				SS DS NS NO	N Y	N Y					
				SS DS NS NO	N Y	N Y					
				SS DS NS NO	N Y	N Y					

Comments

TURNOUTS

Turnout ID Number	Switch Point Location (Station)	Direction	Point Length (LF)	Rail Weight (lbs/yd)	Frog Type	Frog Size	Guard Rail Length (LF)	Comments
1TF	44+[illegible]	LH EQ RH	13	90	B SG RBM SP	7	11	
		LH EQ RH			B SG RBM SP			

CURVES

Curve ID Number	Curvature (Degrees) 1	2	3	4	5	6	7	8	Avg	Superelevation (inches)	Max Desired Speed (mph)	Comments
1C	5	9	1	8	1	8	1	8	3		20	
2C	5	4	5	3	4	5	5	5	4.5		20	

CROSSINGS

Road Name/Crossing Identity or Crossing Segment Number	Centerline Location (Station)	GRADE CROSSINGS Road Crossing ID Number	Crossing Length (feet)	Crossing Type	Protection	Bolted Joints	RAIL CROSSINGS Rail Weight (lbs/yd)	Frog Type	Crossing Angle (degree)
BRADLEY BLVD	30+48	——	24	TIMBER, ASP	G F S N	N Y		B MI SM	
201	12+29				G F S N	N Y	90	B MI SM	20
					G F S N	N Y		B MI SM	
					G F S N	N Y		B MI SM	

Comments

CLEARANCE RESTRICTIONS AND RELATED FACILITIES

Circle One or Both	Begin Location (Station)	End Location (Station)	Obstruction and/or Facility Type	Restriction Measurement (ft.) Horiz.	Vert.	Facility Number	# of Box Car Positions (Docks), or Tangent Track Length (Ramps)	Comments
CR RF			D R					
CR RF			D R					
CR RF			D R					

DRAINAGE STRUCTURES

Centerline Location (Station)	Type	Size (in. x in.)	Material
47+41	[illegible]	36	CONCRETE

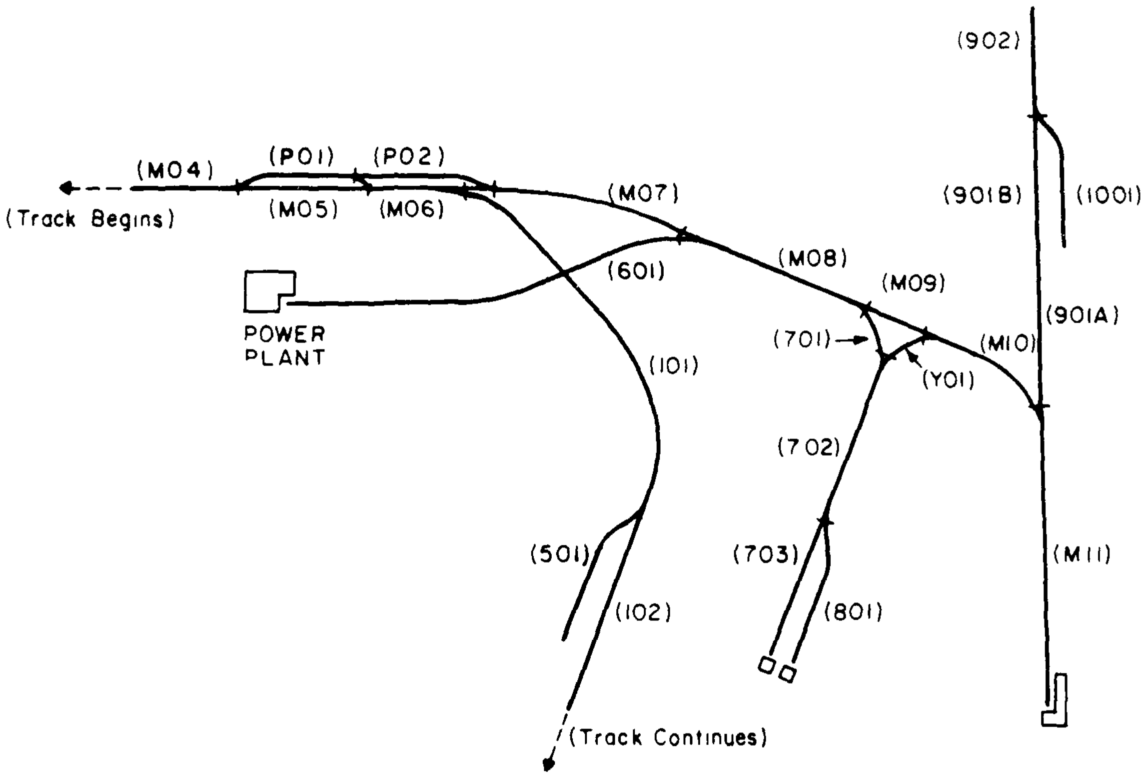
Comments BRIDGER CREEK

BRIDGES

Facility Number	Begin Location (Station)	End Location (Station)	Ballasted	Construction Type
			N Y	
			N Y	

Comments

Figure 20. Completed track segment inventory form for Fort Example.



Track Segment Number	Preceding Track Segment Number
M04	M03 *
M05	M04
M06	M05, P01
M07	M06, P02
M08	M07
M09	M08
M10	M09
M11	M10
101	M06
102	101
501	101
601	M08
701	M08
702	701, Y01
703	702
801	702
Y01	M10
901A	M11
901B	901A
902	901B
1001	902
P01	M04
P02	P01

* Not Shown In Figure

Figure 21. Selected preceding track segment numbers for Fort Example.

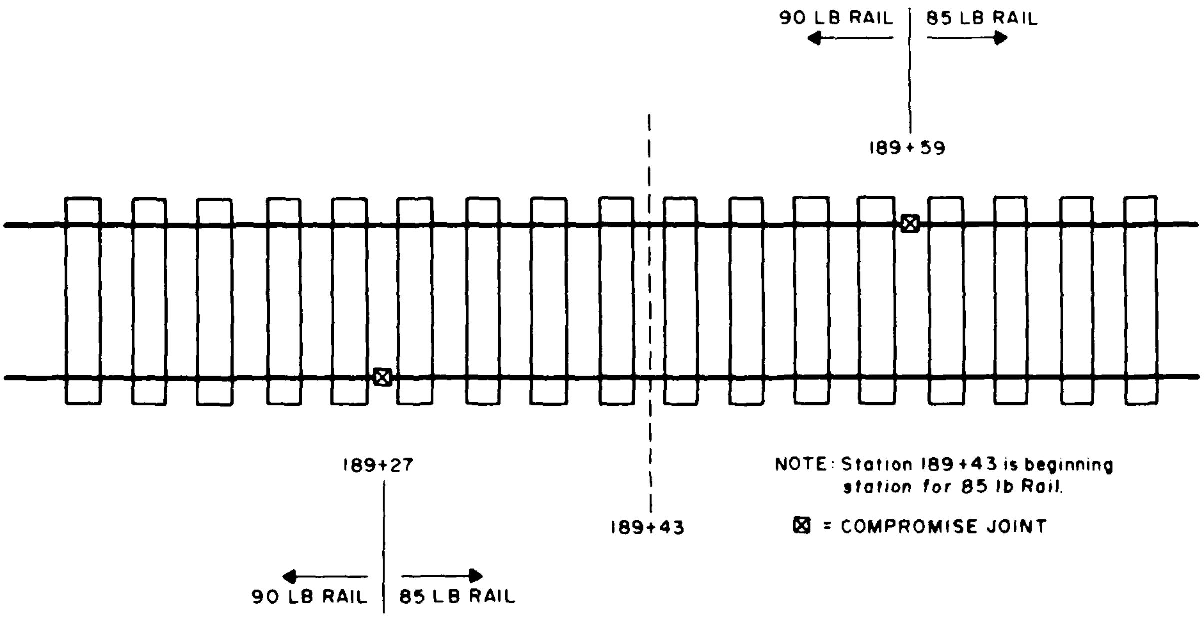


Figure 22. Rail weight beginning location between staggered compromise joints at Fort Example.

Figure 23. Rail weight and section on rail web.

Figure 24. Compromise joint—factory-made.

Figure 25. Compromise joint—field-constructed.

Figure 26. Measurement of tie plate length.

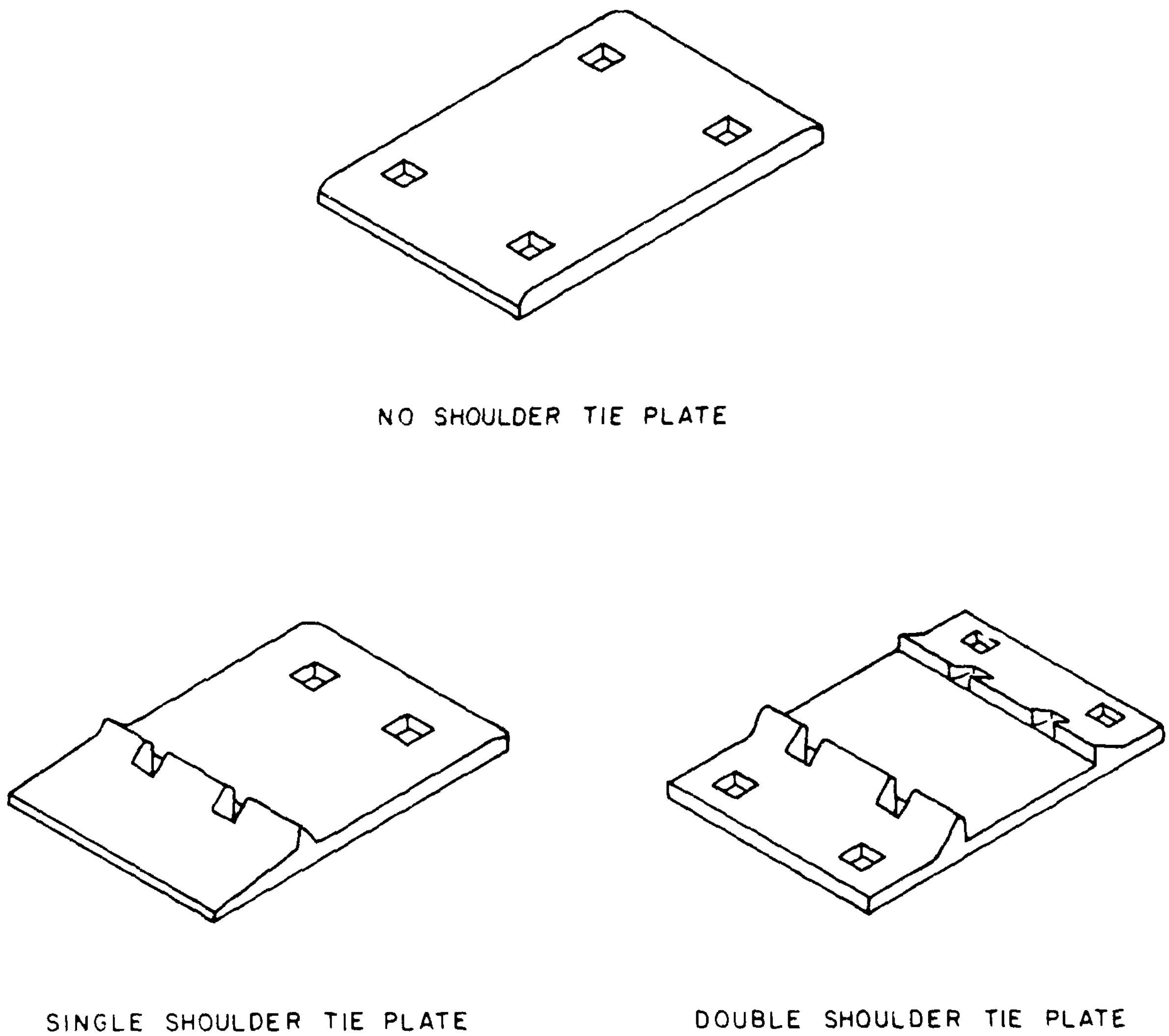


Figure 27. Types of tie plates.

Figure 28. Rail anchors.

Figure 29. Gauge rod.

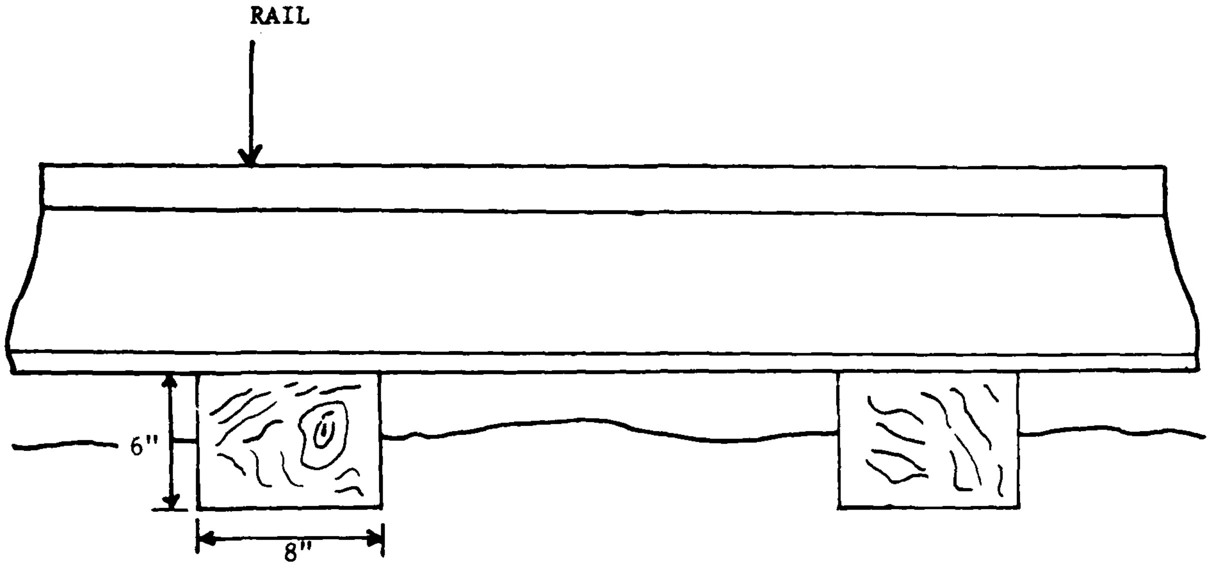


Figure 30. Tie cross sectional dimensions.

Figure 31. Measuring the top dimension of a tie.

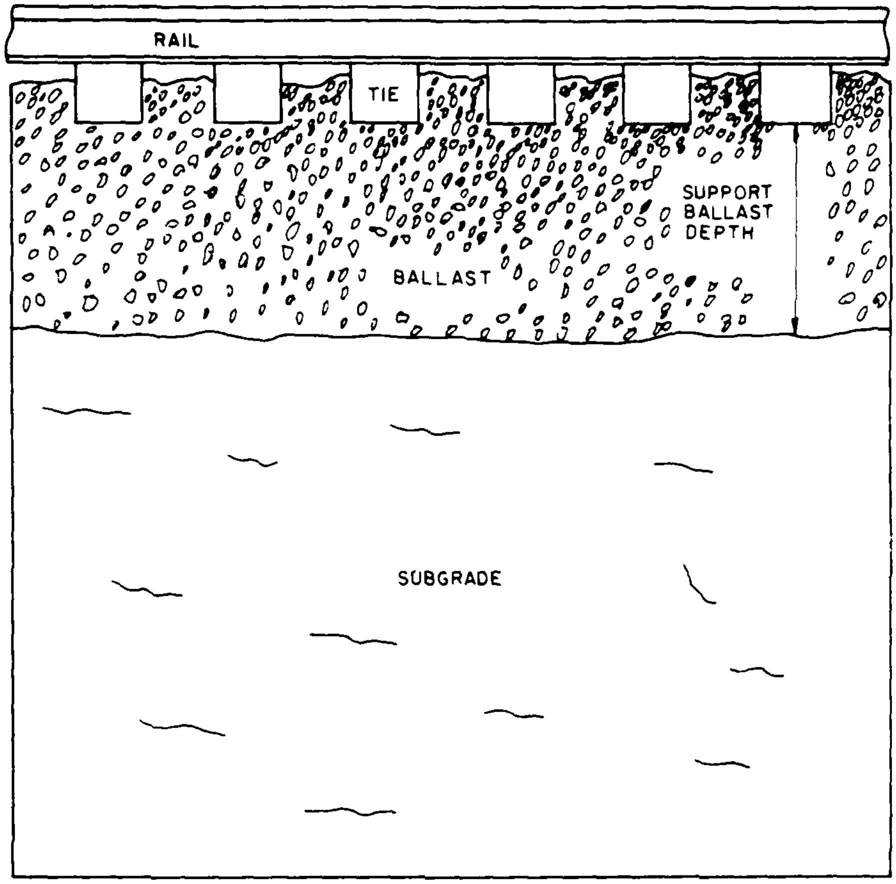


Figure 32. Support ballast depth.

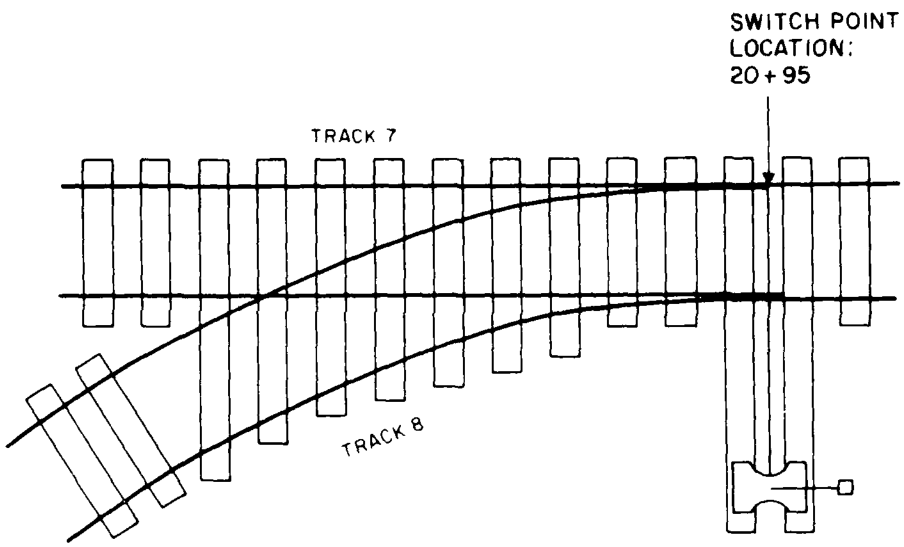


Figure 33. Switch point location.

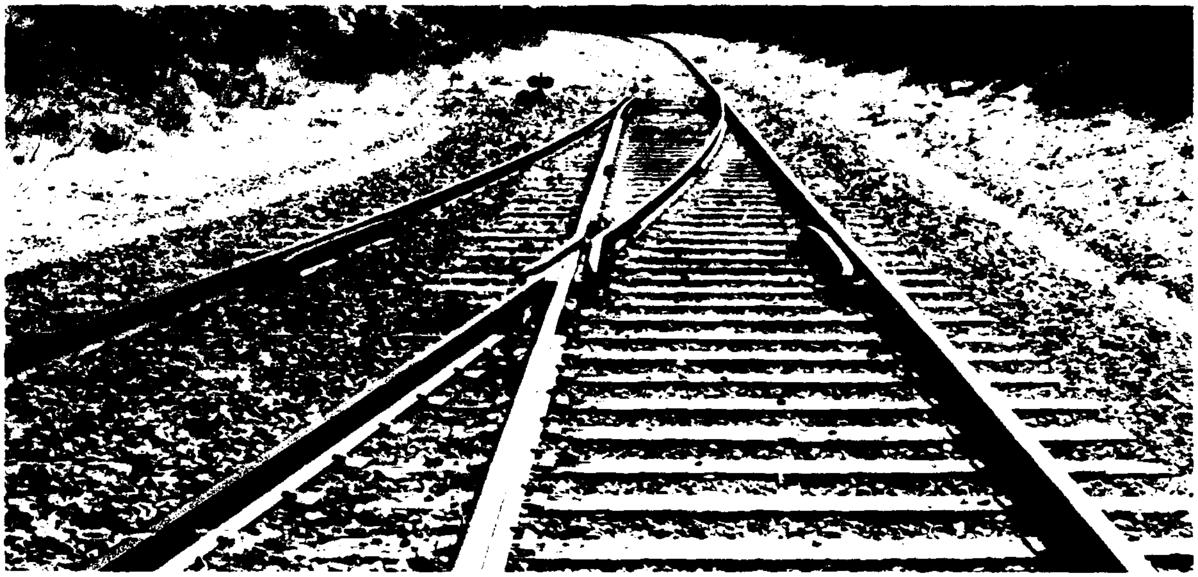


Figure 34. Right-hand turnout.

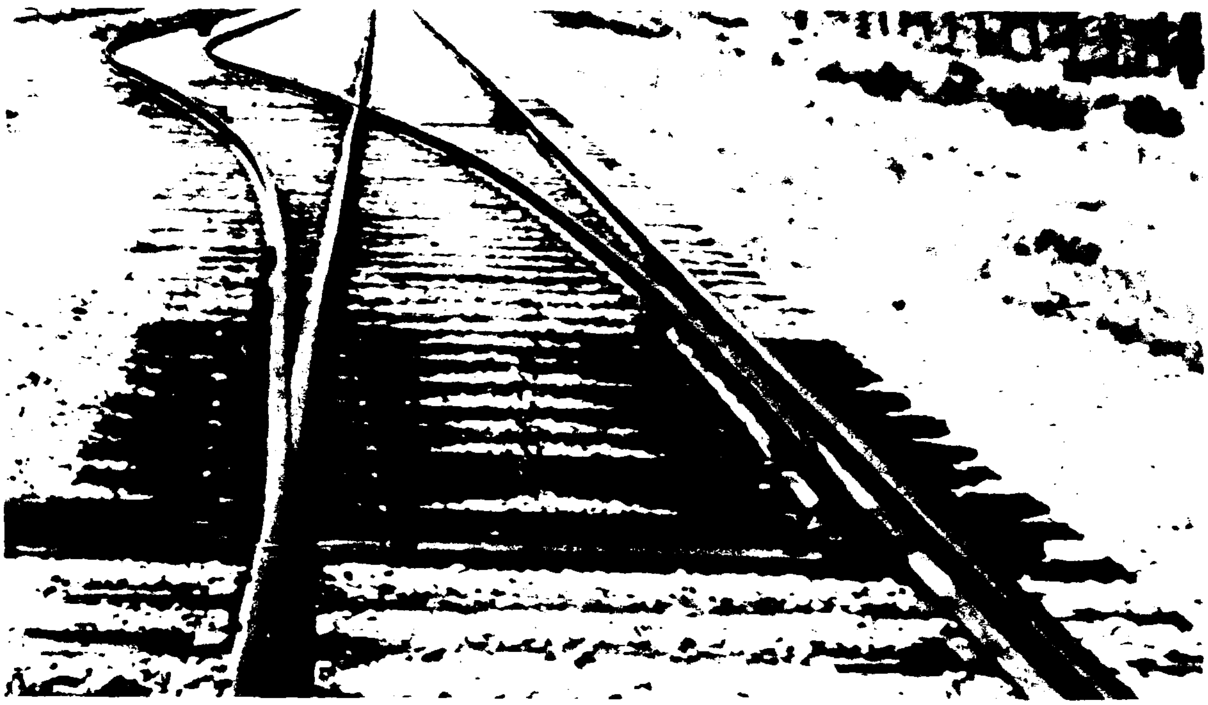


Figure 35. Left-hand turnout.

Figure 36. Switch point length measurement.

Figure 37. Bolted frog for turnout.

Figure 38. Rail-bound manganese (RBM) frog for turnout.

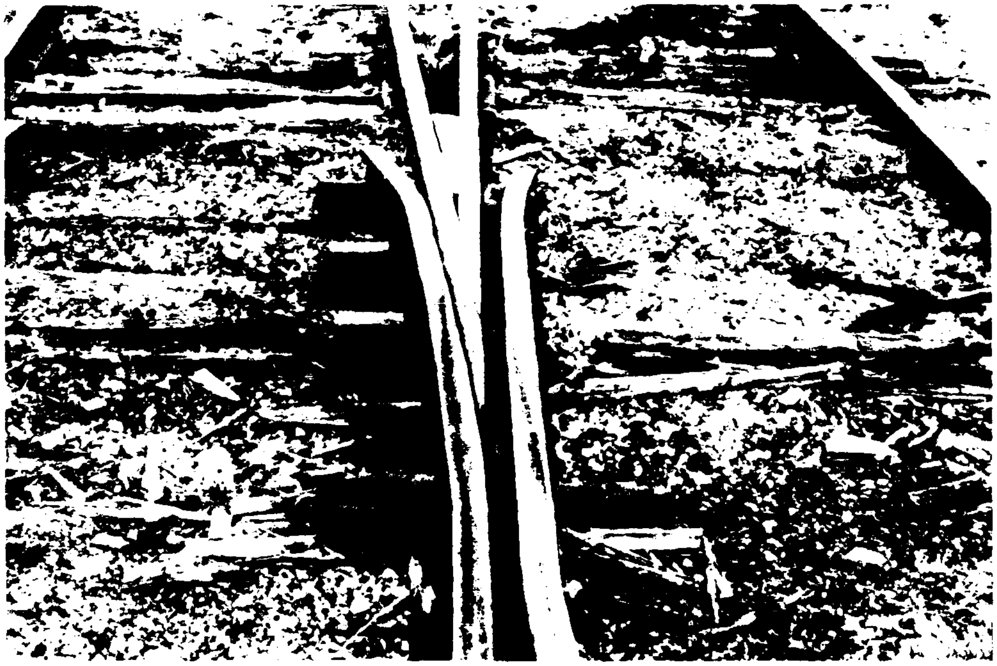


Figure 39. Spring frog for turnout.

Figure 40. Self-guarded frog for turnout.

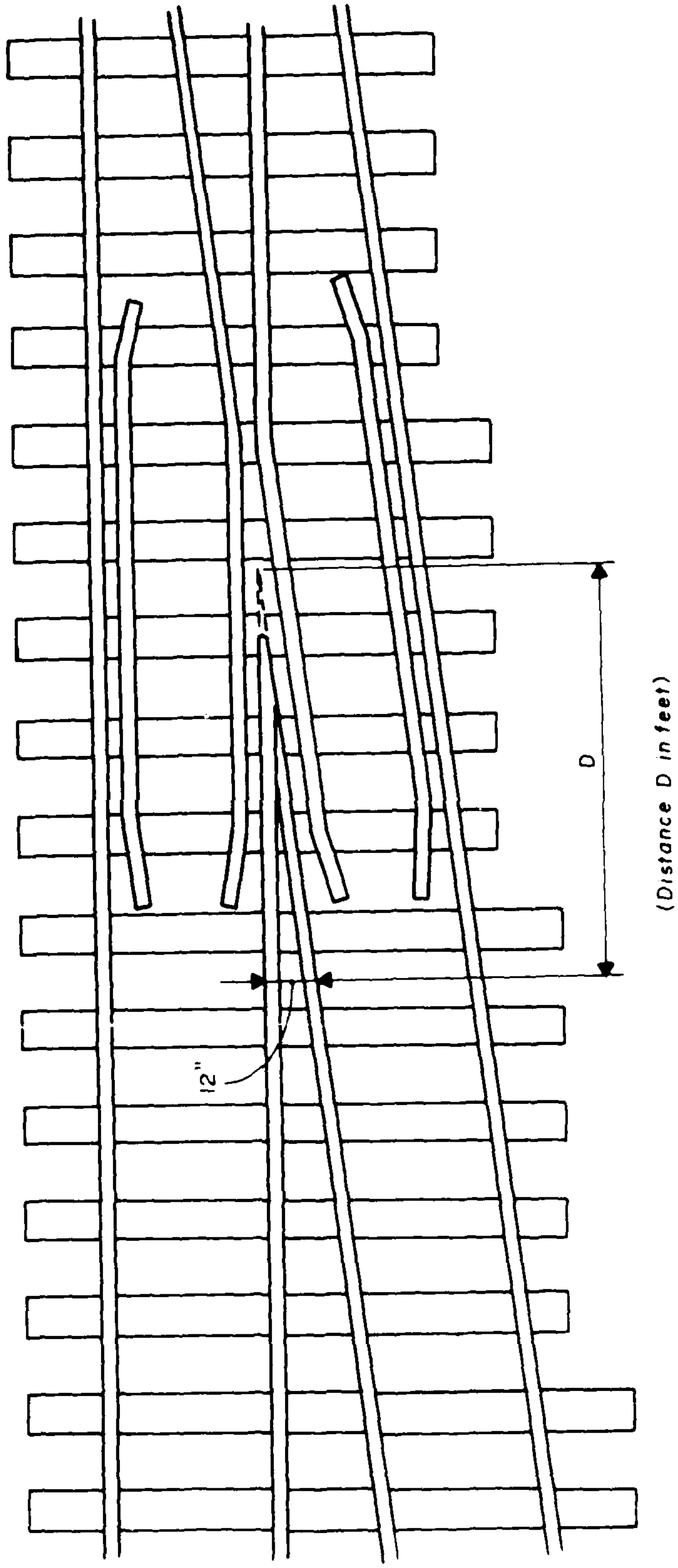


Figure 41. Frog size concept.

(a)

(b)

Figure 42. Measurement of frog size: (a) step 1—finding 1-ft width and (b) step 2—measuring from point to 1-ft mark.

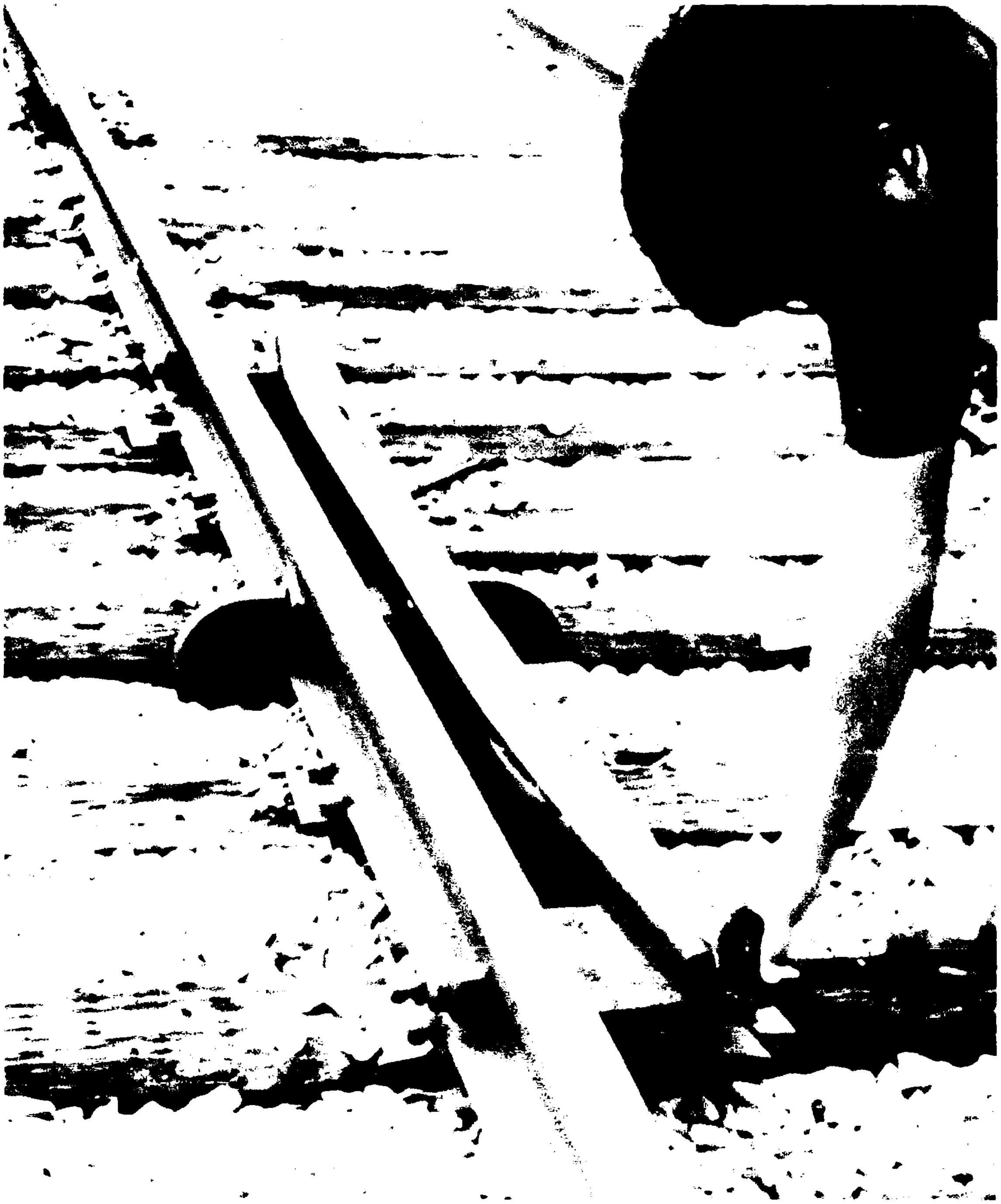
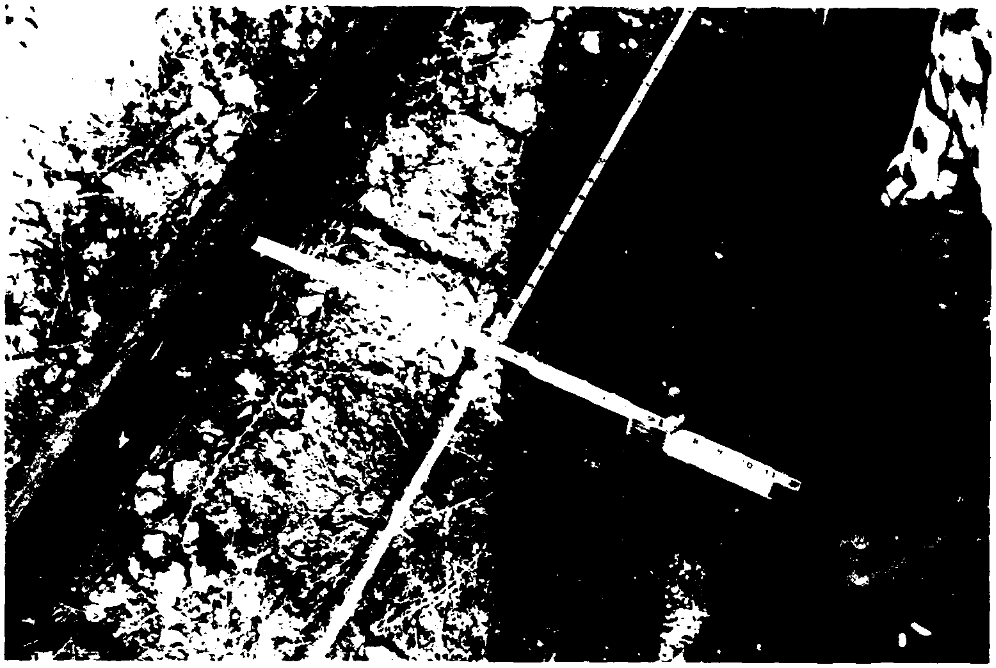


Figure 43. Measurement of guard rail length.

(a)

(b)

Figure 44. Four views of curve measurement: (a) overall, (b) holding end of tape, (c) measuring degree of curve at 31-ft mark, and (d) holding tape at 62-ft mark.



(c)

(d)

Figure 44. (Cont'd)

Table 3

Superelevation for Curved Track*

Degree of Curvature	Maximum Operating Speed (mph) 10	15	20	25	30	35	40	45	50
0.50									
1.00									
1.50								0.25	0.75
2.00			NO SUPERELEVATION REQUIRED				0.25	1.00	1.50
2.50						0.25	0.75	1.50	2.50
3.00						0.50	1.50	2.25	3.25
3.50					0.25	1.00	2.00	3.00	4.00
4.00					0.50	1.50	2.50	3.75	
4.50					1.00	2.00	3.00		
5.00				0.25	1.25	2.25	3.50		
5.50				0.50	1.50	2.75			
6.00				0.75	1.75	3.25			
6.50				1.00	2.00	3.50			
7.00				1.00	2.50	4.00			
7.50			0.25	1.25	2.75				
8.00			0.25	1.50	3.00				
8.50			0.50	1.75	3.50				
9.00			0.50	2.00	3.75				
9.50			0.75	2.25	4.00				
10.00			0.75	2.50					
10.50			1.00	2.50					
11.00			1.00	2.75					
11.50			1.25	3.00					
12.00			1.50	3.25					
13.00			1.75	3.75					
14.00		0.25	2.00	4.00					
15.00		0.50	2.25						
16.00		0.50	2.50						
17.00		0.75	2.75						
18.00		1.00	3.00						
19.00		1.00	3.50						
20.00		1.25	3.50						

SUPERELEVATION MUST NOT EXCEED 4.00 INCHES

Notes

Superelevation Calculated using two - inch unbalanced formula, i.e.

$$E = (0.0007DV^2) - 2$$

where: E = Superelevation, inches
D = Degree of Curvature
V = Speed, mph

All values have been rounded to 1/4 inch increments.

*Source: Technical Manual (TM) 5-628, *Railroad Track Standards* (HQDA, May 1988), p 51.

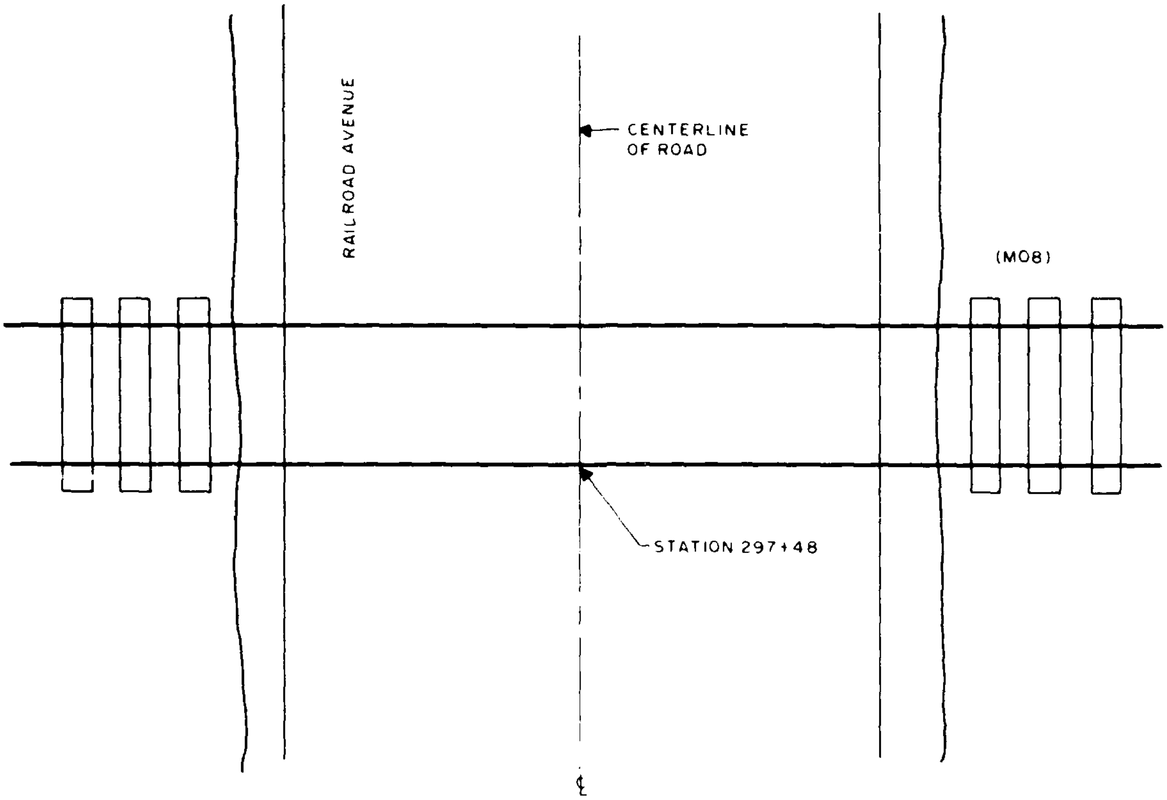


Figure 45. Road crossing centerline location at Fort Example.

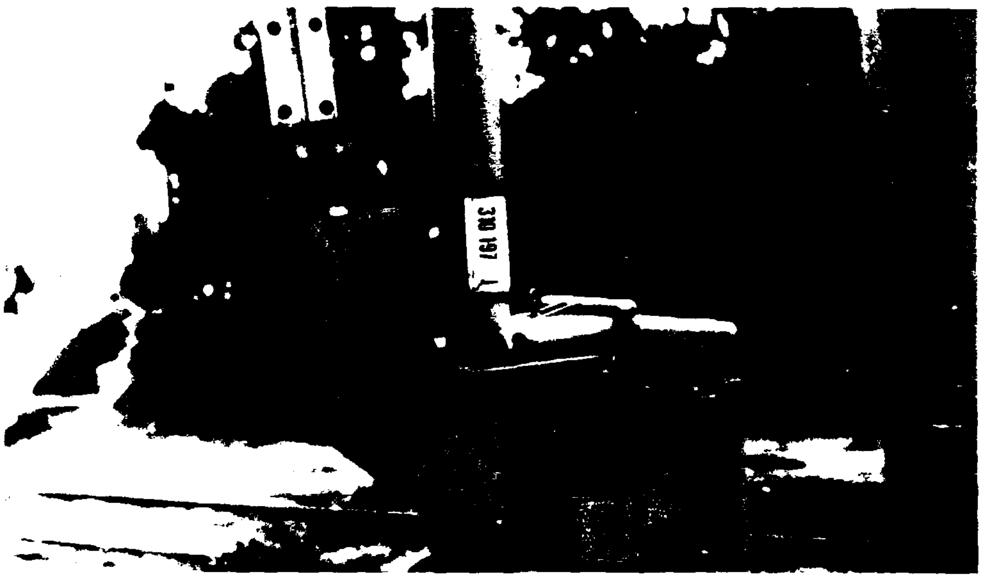


Figure 46. Road crossing identification number.

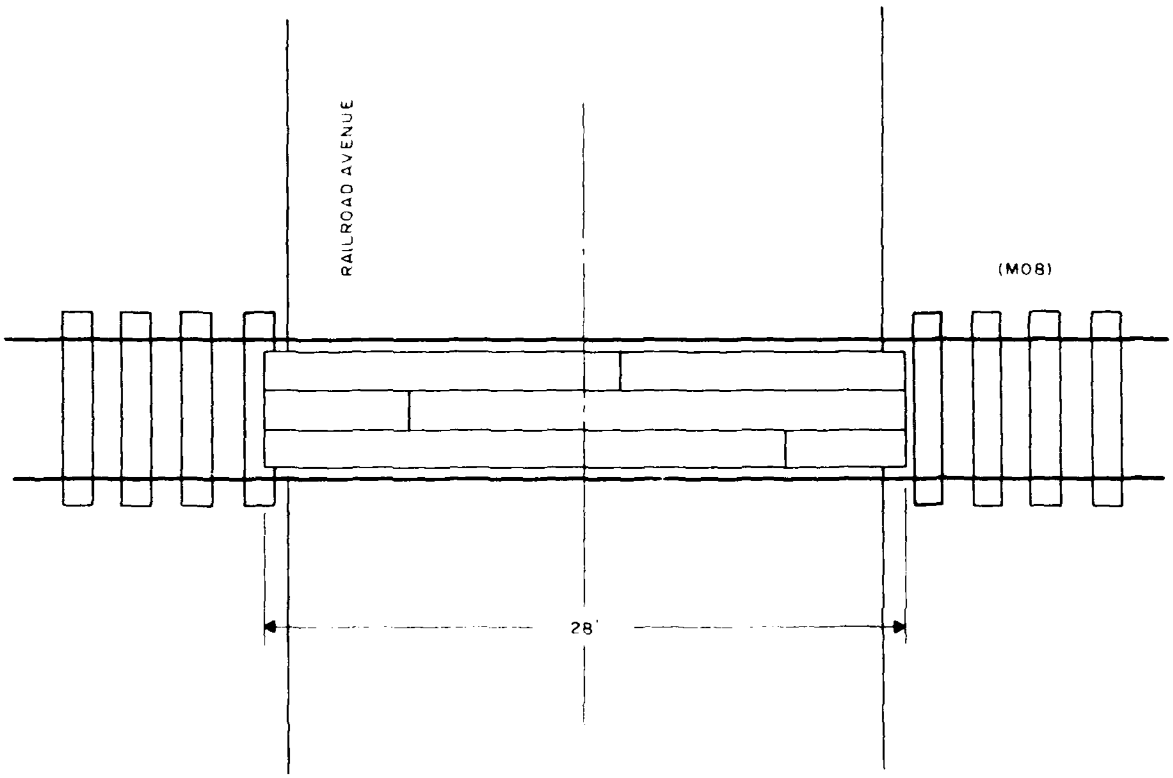


Figure 47. Road crossing length at Fort Example.

Figure 48. Asphalt road crossing.

Figure 49. Concrete road crossing.

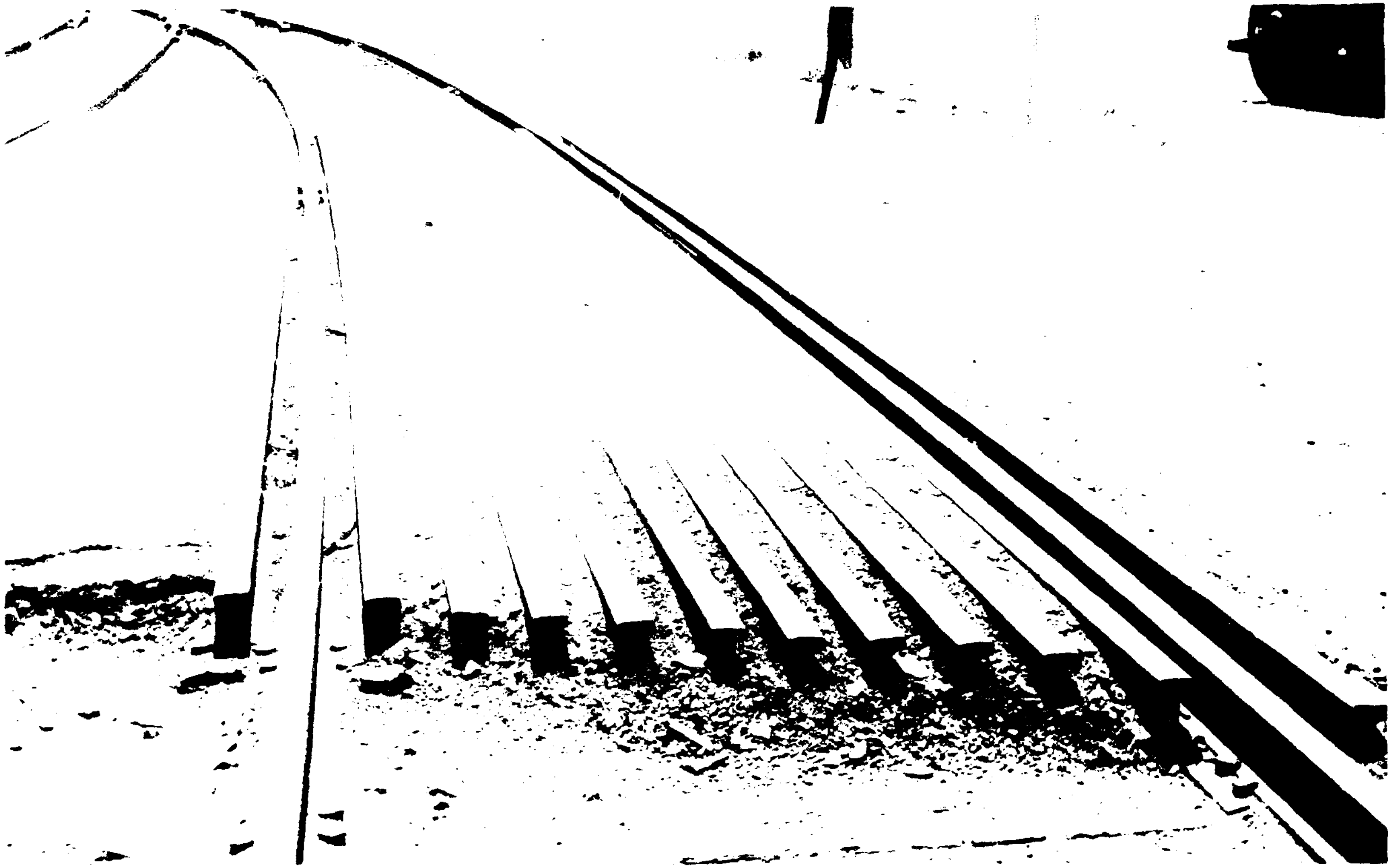


Figure 50. Rail-type road crossing.

Figure 51. Timber road crossing.

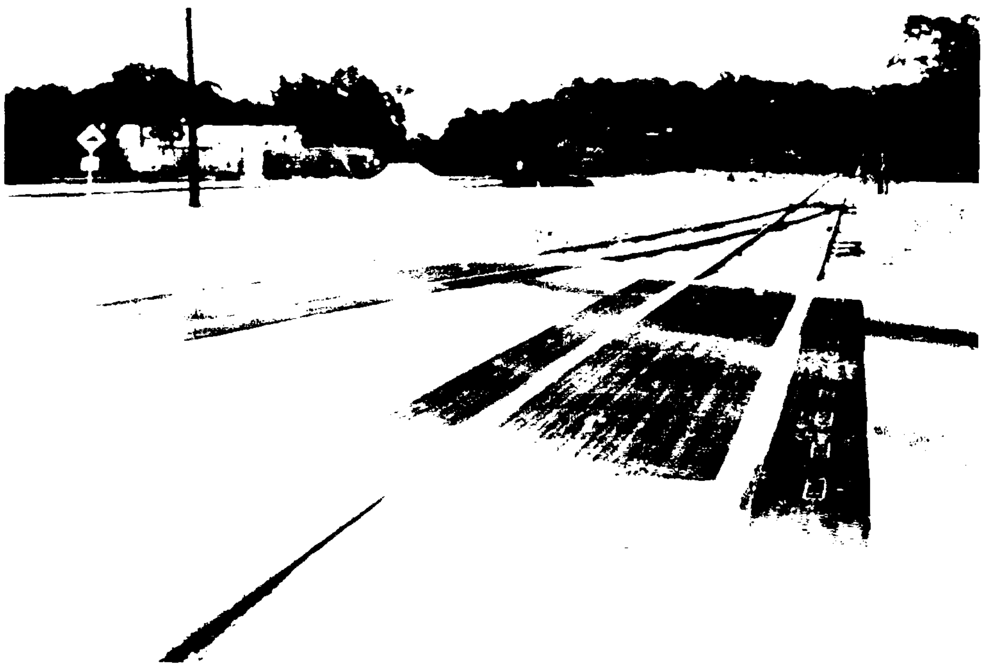


Figure 52. Rubber road crossing.

Figure 53. Timber and asphalt road crossing.

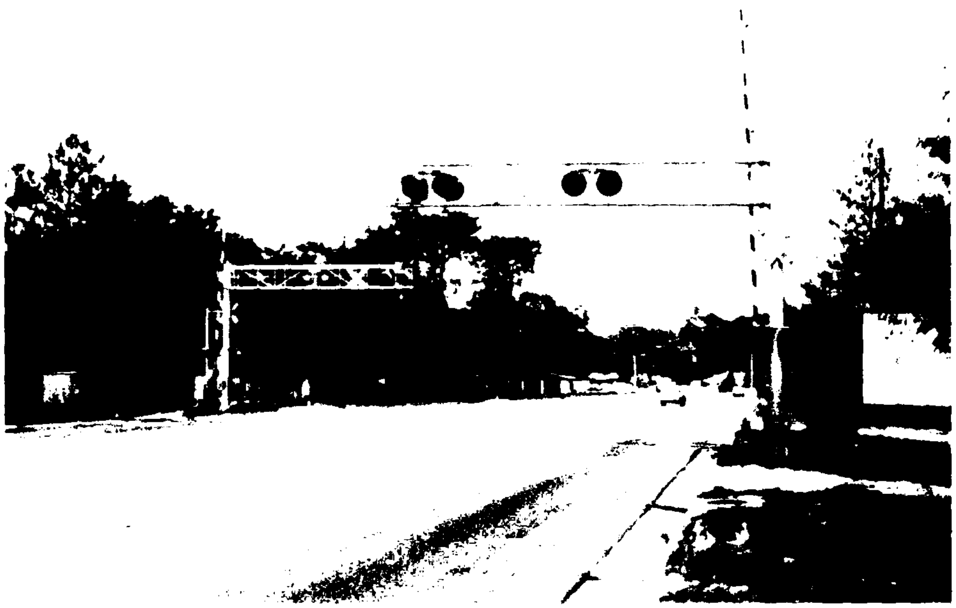


Figure 54. Gates used for road crossing protection.

Figure 55. Flashers used for road crossing protection.

Figure 56. Signs used for road crossing protection.

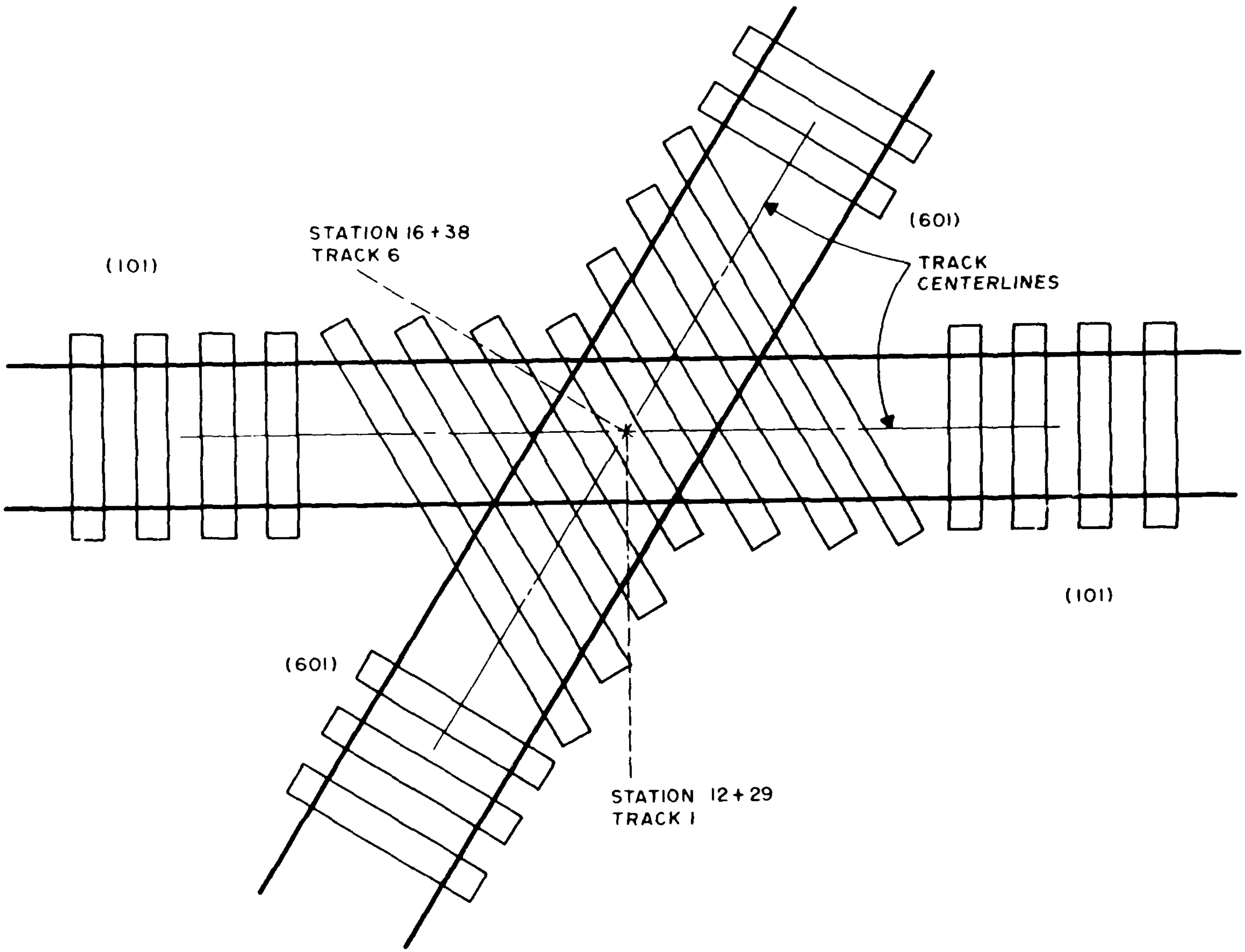
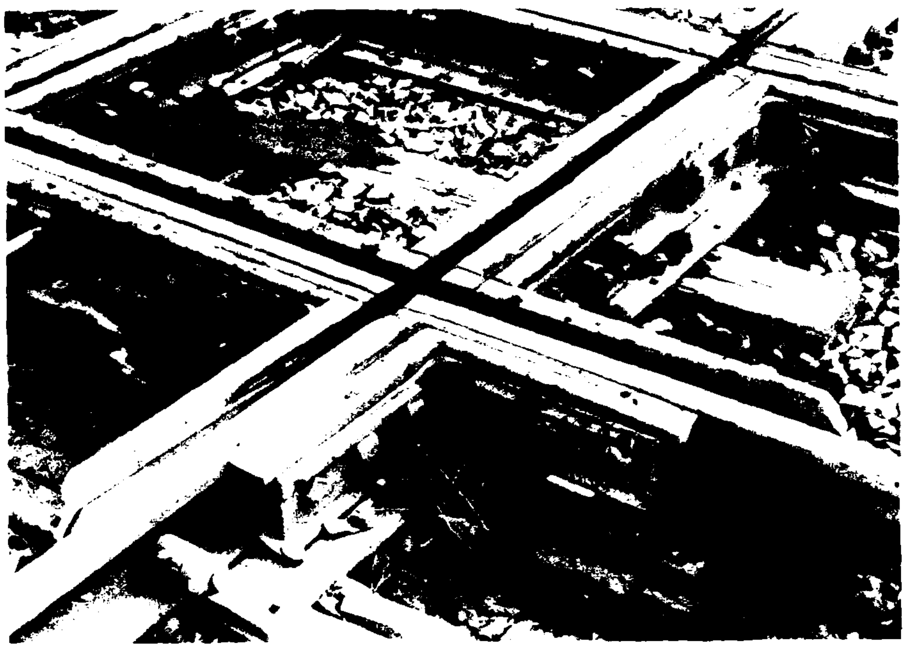


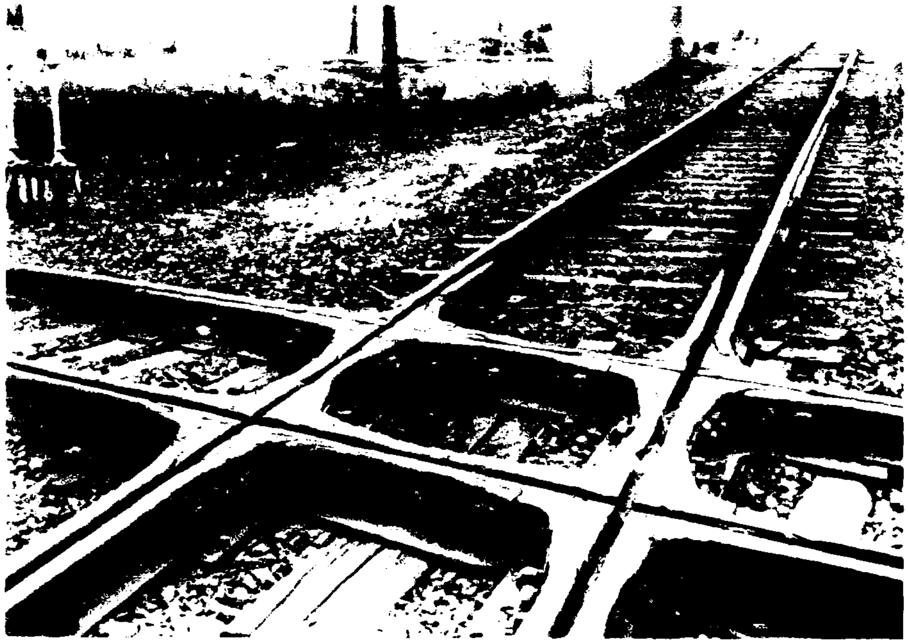
Figure 57. Rail crossing centerline location at Fort Example.

(a)



(b)

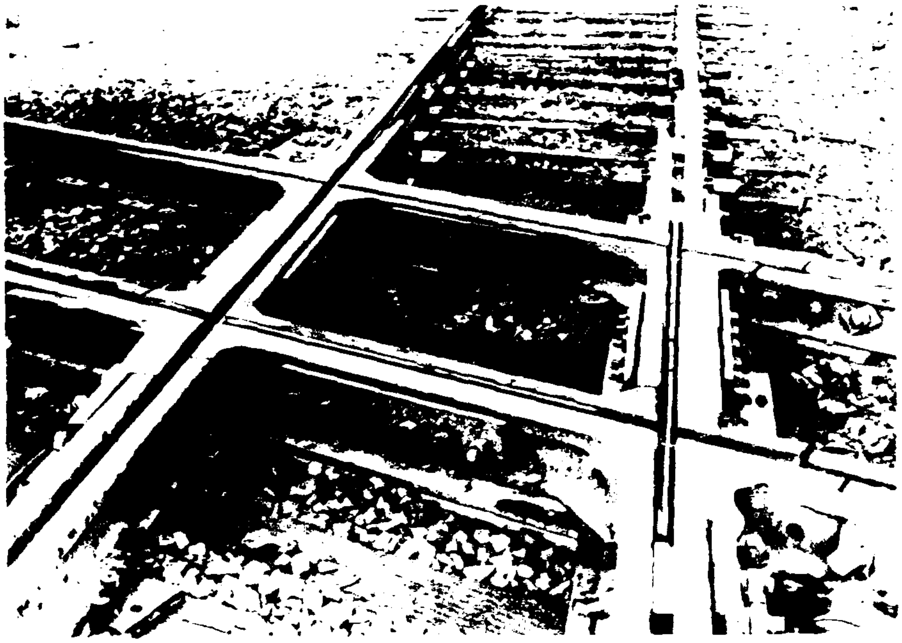
Figure 58. Bolted frog for rail crossing: (a) distant view and (b) closeup.



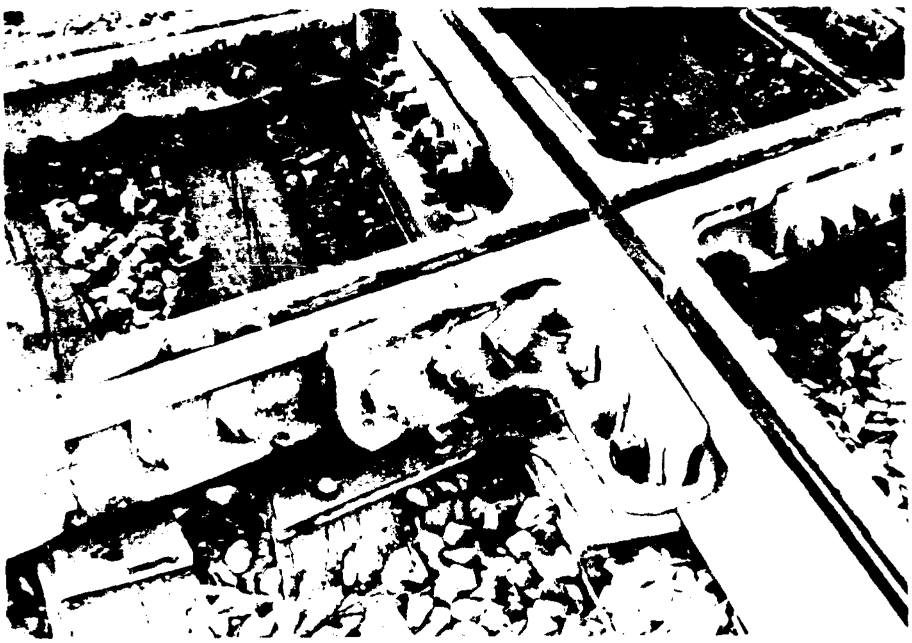
(a)

(b)

Figure 59. Manganese insert frog for rail crossing: (a) distant view and (b) closeup.



(a)



(b)

Figure 60. Solid manganese frog for rail crossing: (a) distant view and (b) closeup.

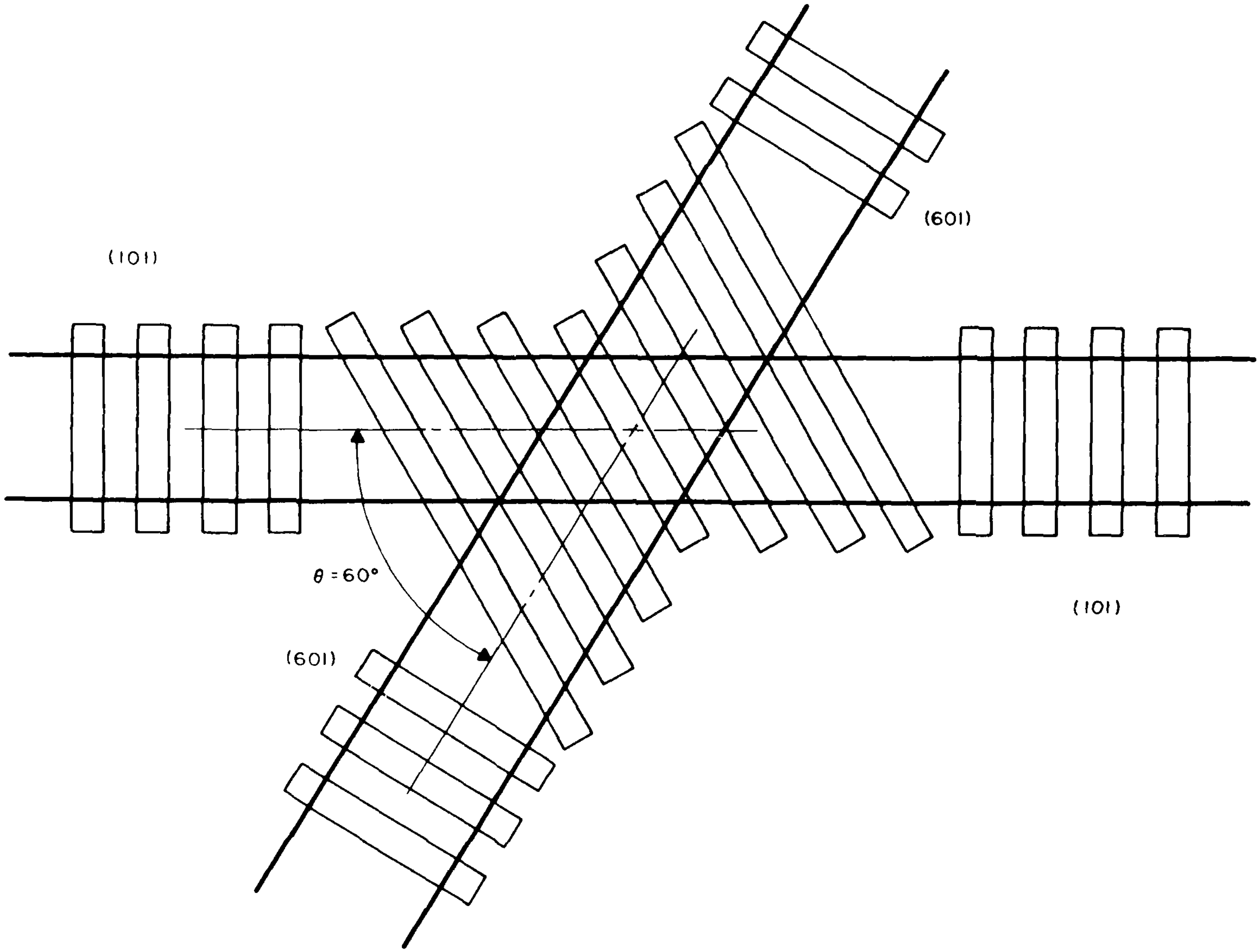


Figure 61. Rail crossing angle at Fort Example.

Figure 62. Horizontal obstruction measurement.

Figure 63. Vertical restriction measurement.

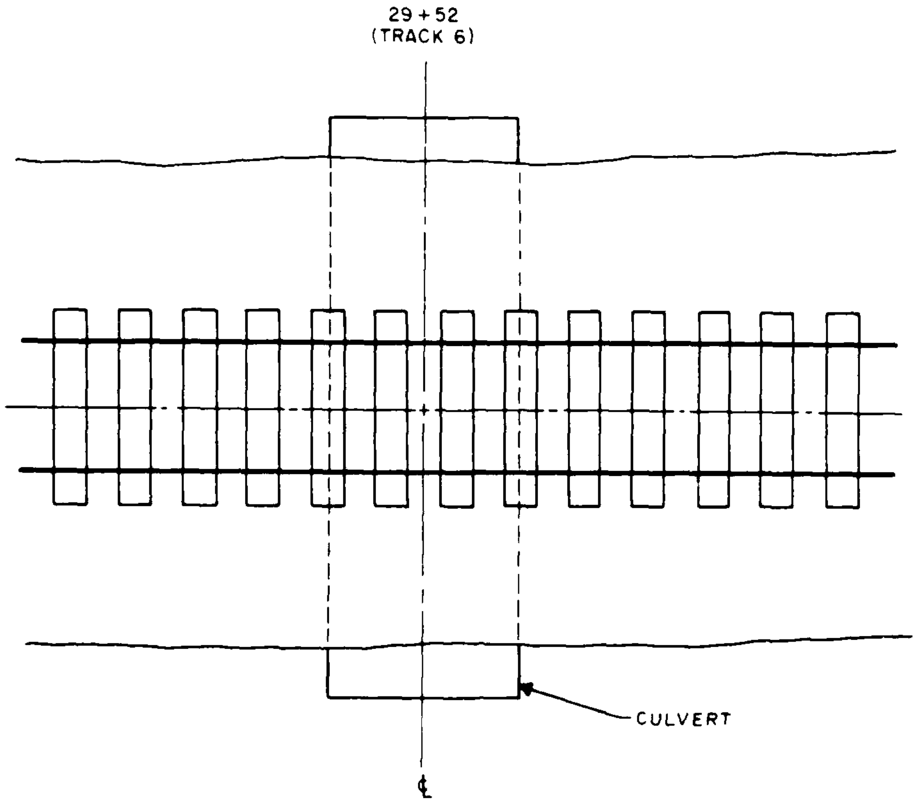


Figure 64. Drainage structure centerline location at Fort Example.

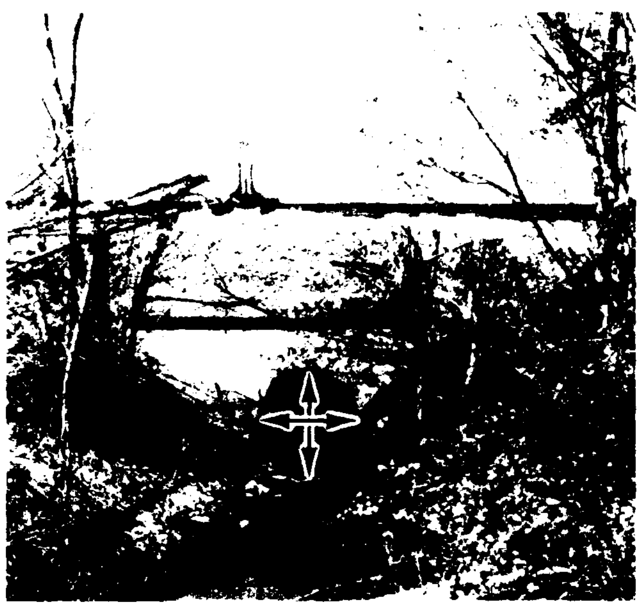


Figure 65. Measuring the diameter o^r^ size of a culvert.

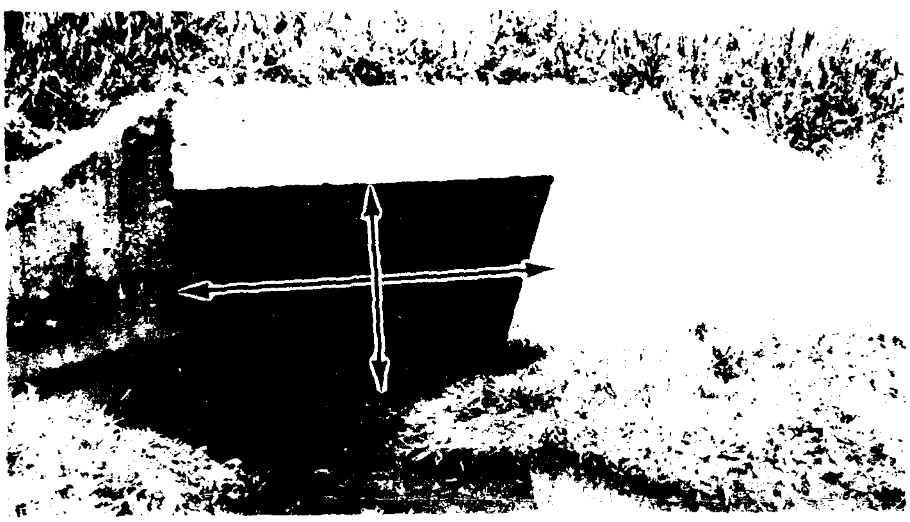


Figure 65. (cont'd)

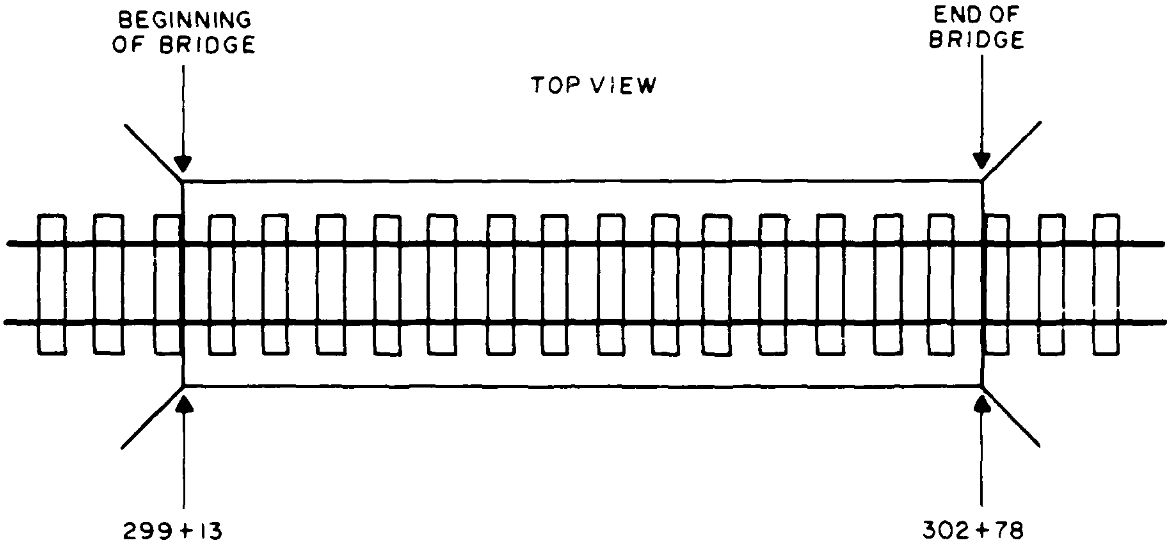


Figure 66. Bridge beginning and end locations at Fort Example.

Figure 67. Beginning station location of bridge.

(a)

(b)

Figure 68. Two types of nonballasted bridges: (a) open and (b) closed.

Figure 69. A ballasted bridge deck.

5 CONCLUSIONS AND RECOMMENDATIONS

The first phase of the Railroad Maintenance Management System (RAILER) has been completed and field-tested successfully. This phase covers track component identification and inventory. The principles described herein are fundamental to the RAILER system and should always be implemented as the first step in using the system. Installations may choose to: (1) end with this step, (2) implement the rest of the RAILER program, or (3) apply a given set of RAILER options tailored to their individual needs.

A procedure has been described for dividing installation railroad networks into specific tracks and track segments. The track segment is the basic unit in RAILER; groups of segments comprise the individual tracks which, in turn, form the entire track network at an installation.

The location reference system for RAILER has been explained. Examples and illustrations showing how the system works have been provided.

Finally, this report has described the major inventory data elements and important element attributes needed for maintenance management along with the methods of data collection.

It is recommended that all Army installations with trackage implement the component identification procedures and track reference system. This step will, as a minimum, provide the Army with a standardized procedure for describing railway networks and determining how much track actually requires management. For given installations, the amount of track, the level and types of traffic, and installation mission as impacted by the track network will determine the extent to which RAILER should be further implemented.

Before attempting to use the processes outlined in this report, personnel must become thoroughly familiar with the methods. Classroom and on-the-job instruction by knowledgeable personnel are highly recommended. This training will expedite the data collection process and reduce the potential for error.

CITED REFERENCES

Civil Rail Lines Important to National Defense (Military Traffic Management Command, July 1986).

Hay, W. W., *Railroad Engineering*, 2nd Ed. (John Wiley and Sons, New York, 1982).

Integrated Facilities System User's Manual (Facilities Engineering Support Agency [FESA], Fort Belvoir, VA, January 1979).

RPMA Component Inspection Handbook (FESA, Fort Belvoir, VA, May 1979).

Shahin, M. Y., *Development of the U.S. Army Railroad Track Maintenance Management System (RAILER)*, Technical Report M-86/01/ADA168915 (U.S. Army Construction Engineering Research Laboratory [USA-CERL], May 1986).

Solverson, S. C., M. Y. Shahin, and D. R. Burns, *Development of a Railroad Track Maintenance Management System for Army Installations: Initial Decision Report*, Technical Report M-85/04/ADA149491 (USA-CERL, November 1984).

Technical Manual (TM) 5-628, *Railroad Track Standards* (Headquarters, Department of the Army [HQDA], May 1988).

Track Safety Standards (Federal Railroad Administration Office of Safety, U.S. Department of Transportation, 1982).

D. R. Uzarski, D. E. Plotkin, and D. G. Brown, *The RAILER System for Maintenance Management of U.S. Army Railroad Networks: RAILER I Description and Use*, Draft Technical Report (USA-CERL, February 1988).

UNCITED REFERENCES

Armstrong, J. H., *The Railroad—What It Is, What It Does—The Introduction to Railroading* (Simmons-Boardman Publishing, Omaha, 1978).

Army Regulation (AR) 420-72, *Surfaced Areas, Railroads, and Associated Structures* (HQDA, March 1976).

Coleman, D. M., *Synthesis of Railroad Design Methods, Track Response Models, and Evaluation Methods for Military Railroads*, Report GL-85-3 (U.S. Army Engineer Waterways Experiment Station, 1985).

Fazio, A. E., "Track Maintenance: Management and Planning," *ASCE Journal of Transportation Engineering*, Vol 106, No. TE6 (November 1980), pp 705-720.

Fazio, A. E., and R. Prybella, "Development of an Analytical Approach to Track Maintenance Planning," *Transportation Research Record*, Vol 744 (1980), pp 46-72.

Inoue, T., "Computerized Supervision of Track Maintenance," *Japanese Railway Engineering*, Vol 15, No. 1 (1974), pp 9-13.

Milospuic, B., "Determining the Depth of Ballast" *International Railway Congress Association*, Vol 46, No. 2 (February 1969).

Peterson, W. B., "Maintenance-of-Way Project Management: Productivity Planning and Control," *Transportation Research Record*, Vol 1042 (1985), pp 12-15.

Shahin, M. Y., "Development of the U.S. Army Railroad Track Maintenance Management System (RAILER)," *Transportation Research Record*, Vol 1030 (1985), pp 15-21.

"Short Line Railroads: Not Getting Caught Short," *Railway Track and Structures*, Vol 78, No. 3 (March 1982), pp 31-33.

Trask, E. R., "Principles of Maintenance-of-Way Planning," *Transportation Research Record*, Vol 1042 (1985), pp 8-11.

APPENDIX A:

BLANK NETWORK AND SEGMENT INVENTORY FORMS

RAILER II
INSTALLATION NETWORK INFORMATION

Date: ________

INSTALLATION INFORMATION

Installation Number	Primary Installation Number	Installation Name	State Code

SERVING RAILROAD(S) INFORMATION

Company Name	Company Code	NEAREST MOBILIZATION CAPABLE YARD		
		Location	Direction	Highway Distance (miles)

SERVING RAILROAD TRACKAGE

Company Code	Track Designation	Track Length (miles)	Operation Capable
			N Y
			N Y

INSTALLATION TRACK DRAWINGS

Drawing Number	Drawing Title

INSTALLATION TRACKAGE

Track Number	Track Length (feet)	Number of Segments	Track Number	Track Length (feet)	Number of Segments	Track Number	Track Length (feet)	Number of Segments

TRACK SEGMENT # ____________ RAILER II DATE ________

INSTALLATION NAME ____________

TRACK SEGMENT INVENTORY INFORMATION

SEGMENT IDENTIFICATION

Begin Location (station)	End Location (station)	Track Category	Track Use	Track Rank	Construction Code	Preceding Track Segment Number(s)	Comments
		A B C	Acc Aux L Se St		P S T L		

TRACK STRUCTURE

Begin Location (station)	RAIL Weight (lbs/yd)	RAIL Section	TIE PLATE Length (inches)	TIE PLATE Shoulder	RAIL ANCHORS	GAUGE RODS	TIES Cross Section (in x in)	TIES Quantity # 200TF	TIES Material Type	BALLAST Support Depth (inches)	BALLAST Type
				SS DS NS NO	N Y	N Y					
				SS DS NS NO	N Y	N Y					
				SS DS NS NO	N Y	N Y					
				SS DS NS NO	N Y	N Y					

Comments

TURNOUTS

Turnout ID Number	Switch Point Location (Station)	Direction	Point Length (LF)	Rail Weight (lbs/yd)	Frog Type	Frog Size	Guard Rail Length (LF)	Comments
		LH EQ RH			B SG RBM SP			
		LH EQ RH			B SG RBM SP			

CURVES

Curve ID Number	Curvature (Degrees) 1	2	3	4	5	6	7	8	Avg	Superelevation (inches)	Max Desired Speed (mph)	Comments

CROSSINGS

Road Name/Crossing Identity or Crossing Segment Number	Centerline Location (Station)	GRADE CROSSINGS Road Crossing ID Number	Crossing Length (feet)	Crossing Type	Protection	Bolted Joints	RAIL CROSSINGS Rail Weight (lbs/yd)	Frog Type	Crossing Angle (degree)
					G F S N	N Y		B MI SM	
					G F S N	N Y		B MI SM	
					G F S N	N Y		B MI SM	
					G F S N	N Y		B MI SM	

Comments

CLEARANCE RESTRICTIONS AND RELATED FACILITIES

Circle One or Both	Begin Location (Station)	End Location (Station)	Obstruction and/or Facility Type	Restriction Measurement (ft) Horiz.	Vert.	Facility Number	# of Box Car Positions (Docks), or Tangent Track Length (Ramps)	Comments
CR RF			D R					
CR RF			D R					
CR RF			D R					

DRAINAGE STRUCTURES

Centerline Location (Station)	Type	Size (in x in)	Material

Comments

BRIDGES

Facility Number	Begin Location (Station)	End Location (Station)	Ballasted	Construction Type
			N Y	
			N Y	

Comments

APPENDIX B:

TABLE OF RAIL DIMENSIONS*

Section	Weight per yd	Height	Base	Head	Web
ARA-A	100	6	5 1/2	2 3/4	9/16
ARA-A	90	5 5/8	5 1/8	2 9/16	9/16
ARA-A	80	5 1/8	4 5/8	2 1/2	33/64
ARA-A	70	4 3/4	4 1/4	2 3/8	1/2
ARA-A	60	4 1/2	4	2 1/4	15/32
ARA-B	100	5 41/64	5 9/64	2 31/32	9/16
ARA-B	90	5 17/64	4 49/64	2 9/16	9/16
ARA-B	80	4 15/16	4 7/16	2 7/16	35/64
ARA-B	70	4 35/64	4 3/64	2 3/8	33/64
ARA-B	60	4 3/16	3 11/16	2 1/8	31/64
ASCE	100	5 3/4	5 3/4	2 3/4	9/16
ASCE	90	5 3/8	5 3/8	2 5/8	9/16
ASCE	85	5 3/16	5 3/16	2 9/16	9/16
ASCE	80	5	5	2 1/2	35/64
ASCE	75	4 13/16	4 13/16	2 15/32	17/32
ASCE	70	4 5/8	4 5/8	2 7/16	33/64
ASCE	65	4 7/16	4 7/16	2 13/32	1/2
ASCE	60	4 1/4	4 1/4	2 3/8	31/64
ASCE	55	4 1/16	4 1/16	2 1/4	15/32
ASCE	50	3 7/8	3 7/8	2 1/8	7/16
ASCE	48	3 11/16	3 49/64	2 5/64	1/2
ASCE	45	3 11/16	3 11/16	2	27/64
ASCE	40	3 1/2	3 1/2	1 7/8	25/64
ASCE	35	3 5/16	3 5/16	1 3/4	23/64
ASCE	30	3 1/8	3 1/8	1 11/16	21/64
ASCE	25	2 3/4	2 3/4	1 1/2	19/64
ASCE	20	2 5/8	2 5/8	1 11/32	1/4
ASCE	16	2 3/8	2 3/8	1 11/64	7/32
ASCE	12	2	2	1	3/16
ASCE	8	1 9/16	1 9/16	13/16	5/32
AREA	100	6	5 3/8	2 11/16	9/16
AT & SF	90	5 3/8	5 3/16	2 9/16	9/16
Bang & Aroost	70	4 3/4	4 3/4	2 7/16	1/2
Can Nor	80	5	5	2 9/16	35/64
Can Pac	85	5 1/8	5	2 1/2	9/16
Can Pac	65	4 31/64	4 3/8	2 1/4	15/32
C of NJ	135	6 1/2	6	3 5/32	3/4
C & A	70	4 3/8	4	2 35/96	35/64
C & NW	100	5 45/64	5 9/64	2 9/16	9/16
C & NW	90	5 17/32	5 3/32	2 1/2	1/2
C & NW	72	4 3/4	4 3/4	2 3/8	9/16

*Adapted from: Technical Manual (TM) 5-628, *Railroad Track Standards* (HQDA, May 1988), p C2.

Section	Weight per yd	Height	Base	Head	Web
CB & Q	85	5 3/16	5 3/16	2 21/32	9/16
D & RG	90	5 1/2	5 1/8	2 9/16	9/16
D & RG	85	5 1/4	5 1/4	2 1/2	9/16
D & RG-C&S	85	5 3/8	4 7/8	2 1/2	9/16
DL & W	105	6	5 3/8	2 3/4	5/8
DL & W	101	5 7/16	5 3/8	2 3/4	5/8
DL & W	91	5 1/4	5 3/8	2 5/8	5/8
DL & W	75	4 11/16	5	2 1/2	1/2
Dudley	90	5 1/2	5	2 31/32	9/16
EJ & E	100	5 9/16	5	2 21/32	9/16
Frictionless	125½	7	5 1/2	1 13/16	11/16
Frictionless	98	5 27/32	5	2 1/2	9/16
Frictionless	97	5 7/8	5 9/64	2 1/4	9/16
Frictionless	93	6 1/8	5 1/2	2 1/8	19/32
Frictionless	92	5 7/16	5 3/8	1 15/16	5/8
Frictionless	90	5 5/8	5 1/8	2 1/4	9/16
Frictionless	90	6 3/32	5 1/8	1 59/64	9/16
Frictionless	79½	5 3/16	5 3/16	1 15/16	9/16
Grt Nor	100	5 3/4	5	2 3/4	9/16
Grt Nor	90	5 3/8	5	2 5/8	5/8
Grt Nor	90	5 3/8	5	2 5/8	19/32
Grt Nor	85	5	5	2 21/32	21/32
Grt Nor	80	5	5	2 13/32	5/8
Grt Nor	77½	5	5	2 3/8	5/8
Hock Val	80	5	4 59/64	2 31/64	29/64
Interb'g'h	100	5 3/4	5 3/4	2 7/8	9/16
Interb'g'h	90	5	5	2 7/8	11/16
Lehigh Val	136	7	6 1/2	2 15/16	21/32
Lehigh Val	110	6	5 1/2	2 7/8	19/32
Mo Pac	85	5 7/32	5 1/4	2 15/32	75/128
Mo Pac	75	4 3/4	4 3/4	2 9/16	9/16
Nat Ry Mex	75	5	5	2 3/4	1/2
NYC	120	7	6	3	31/32
NYC	105	6	5 1/2	3	5/8
NYC	100	6	5 1/2	3	19/32
NYC	95	5 1/32	5 1/2	3	5/8
NYC	80	5 1/8	5	2 31/32	17/32
NYC & St L	85	5 3/8	4 7/8	2 17/32	17/32
NYNH & H	107	6 1/8	5 1/2	2 3/4	19/32
NYNH & H	100	6	5 1/2	2 3/4	19/32
Nor Pac	66	4 17/32	4 1/2	2 5/16	17/32
PS--Penn	130	6 5/8	5 1/2	3	11/16
PS--Penn	125	6 1/2	5 1/2	3	21/32
PS--Penn	100	5 11/16	5	2 43/64	9/16
PS--Penn	85	5 1/8	4 5/8	2 1/2	17/32
PRR	100	5 1/2	5 1/2	2 13/16	5/8
PRR	85	5	5	2 9/16	17/32
PRR	70	4 1/2	4 1/2	2 7/16	1/2
P & R	100	5 5/8	5 3/8	2 31/32	9/16
RG So	52	4	4	2 1/8	25/64

Section	Weight per yd	Height	Base	Head	Web
Russian	67½	5 3/64	4 21/64	2 23/64	15/32
Sea A Ln	85	5 1/4	5	2 11/16	17/32
Sea A Ln	75	5	5	2 9/16	1/2
Soo Ln	85	5 3/8	4 7/8	2 1/2	9/16
UP	90	5 3/4	5 3/8	2 3/4	17/32
UP	75	5	5	2 9/16	33/64
UP	75	4 15/16	4 7/16	2 7/16	33/64
Miscell	75	5	5	2 1/2	9/16
Miscell	70	4 3/4	4 3/4	2 7/16	1/2
Miscell	67	4 1/2	4 1/2	2 13/32	1/2
Miscell	67	4 1/2	4 1/2	2 13/32	1/2
Miscell	65	4 3/8	4 7/16	2 3/8	29/64
Miscell	65	4 1/2	4 1/2	2 7/16	1/2
Miscell	60	4 1/4	4 1/16	2 5/16	1/2
Miscell	60	4 1/4	4 13/64	2 21/64	29/64
Miscell	56	4 1/4	3 31/32	2 7/32	13/32
Miscell	56	4	3 53/64	2 19/64	29/64
Miscell	56	4 1/4	4 1/8	2 1/4	3/8
Miscell	56	4 1/4	4 1/8	2 1/4	53/128

GLOSSARY

ballast - selected material placed on roadbed to hold the track in line and surface.

classification yard - area in which cars are classified or grouped in accordance with requirements.

compromise joint - rail joint between rails of different height and section (weight) or rails of the same section but of different joint drillings.

crib - space between two adjacent ties.

crossover - two turnouts with the track between the frogs arranged to form a continuous passage between two nearby and generally parallel tracks.

curve - bends in the track designed to change the direction of travel.

derail - track structure for tracking rolling stock in case of emergency.

flangeway - open way through a track structure which provides a passageway for wheel flanges.

frog - track structure used at the intersection of two running rails to provide support for wheels and passageways for their flanges, thus permitting wheels on either rail to cross the other.

interchange point - geographical point, yard, junction or track common to the operations of two railroads where cars are routinely interchanged from one railroad to another. For military purposes, an interchange point is where a military installation interchanges cars with a commercial railroad.

interchange track - track used as the interchange point.

interchange yard - yard used as the interchange point.

passing track - track auxiliary to main track for allowing passing trains to meet; a type of siding.

right-of-way - lands or rights used or held for railroad operation.

rolling stock - general term used when referring collectively to a large group of railway cars and sometimes locomotives.

runaround track - track designed for moving around stationary rolling stock; similar to a passing siding. Facilitates switching operations.

siding - track connected at both ends to another (usually superior) track. Possible uses include loading cars, storing cars, switching movements, and passing of trains.

subgrade - finished surface of the roadbed below the ballast and track.

switch points - the tapered rails of a turnout.

turnout - arrangement of a switch and frog with closure rails used to divert trains from one track to another. Also called a split switch turnout.

wye - term used to describe a track arrangement shaped like the letter "Y" but with a connecting segment between the upper legs. This layout allows equipment to be turned around without a turntable.

yard - system of tracks within defined limits provided for making up trains, storing cars, and similar purposes.

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ATTN: Chief, NCRED-G
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ATTN: Chief, ED-D
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